Pilot Period Final Report

Juliet, Kilo, and Tango Ranges

Camp Edwards, Massachusetts

2016

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ACRONYMS AND ABBREVIATIONS

bgs	below ground surface
CAC	Community Advisory Council
CRREL	Cold Regions Research and Engineering Laboratory
DA	Department of the Army
DOD	Department of Defense
EBC	Environmental Bullet Catcher
ECC	Environmental Chemical Corporation
EMC	Environmental Management Commission
EPA	U.S. Environmental Protection Agency
EOEEA	Executive Office of Energy and Environmental Affairs
E&RC	Environmental and Readiness Center
HDPE	High Density Polyethylene
IAGWSP	Impact Area Groundwater Study Program
ISM	Incremental Sampling Methodology
MANG	Massachusetts National Guard
MassDEP	Massachusetts Department of Environmental Protection
JBCC	Joint Base Cape Cod
NCO	Non Commissioned Officer
OMMP	Operations, Maintenance, and Monitoring Plan
Reserve TA	Upper Cape Water Supply Reserve/Camp Edwards Training Area
SAC	Science Advisory Council
SARWG	Small Arms Range Working Group
SDWA	Safe Drinking Water Act
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
WWTP	Waste Water Treatment Plant
kg	kilograms
mg/Kg	milligrams per kilogram
μg/L	micrograms per liter

1.0 INTRODUCTION

1.1 PURPOSE OF REPORT

In July 2007 and January 2009, the U.S. Environmental Protection Agency (EPA) authorized a pilot project under which Massachusetts National Guard (MANG) personnel, and personnel from other military and law enforcement agencies under the MANG's supervision, would be permitted to conduct lead ammunition training at Tango Range, and Juliet and Kilo Ranges, respectively, under specified conditions. The approximately nine-year combined pilot period has allowed an adequate record of use, management, and monitoring to be established to show that these ranges, with appropriate controls, could be managed in an environmentally sound fashion.

The purpose of this report is to provide stakeholders, the EPA, the Environmental Management Commission (EMC) and the Massachusetts Department of Environmental Protection (MassDEP) with a summary of data collected during this Pilot Period. This report also provides a summary to all other members of the Small Arms Range Working Group (SARWG) that includes the MANG Environmental &Readiness Center (E&RC), EPA, MassDEP, the EMC, the Impact Area Groundwater Study Program (IAGWSP), and Camp Edwards staff. The SARWG convenes to discuss and help guide small arms range development on Camp Edwards.

1.2 SCOPE

The MANG was required to complete a Pilot Period Report for the 17-month trial period, August 2007 through December 2008, as part of the EPA's July 2007 limited authorization to conduct lead ammunition training at Tango Range. That report was completed and submitted to the EPA in final form in August 2009. The scope of the present report is to present current information for the Pilot Period relating to Juliet and Kilo Ranges and updating information on Tango Range. The pilot period occurred from 2007 to 2016. This report summarizes the use of the ranges, any operational issues encountered and how they were resolved, all environmental monitoring data, changes made to the systems and the Operations, Maintenance and Monitoring Plan (OMMP), and lessons learned. In addition, Section 7 of this report provides a description of the EMC and the Environmental Performance Standards (EPSs), which govern the use and operation of the ranges under Chapter 47 of the Acts of 2002 for the Commonwealth of Massachusetts.

The Pilot Period was performed in accordance with procedures and policies outlined in the OMMP, for Juliet, Kilo and Tango Ranges (Appendix A). This OMMP has been and will continue to be a dynamic document with changes made to capture lessons learned, to add efficiencies, and to make implementation and compliance easier for the end user: Camp Edwards Range Control and environmental staff with emphasis on staff that does the day-to-day maintenance.

1.3 BACKGROUND

Camp Edwards, located within Joint Base Cape Cod (JBCC), is an important training center for National Guard, Reserve Components, US Coast Guard, and law enforcement agencies throughout the northeastern United States. Training facilities available at Camp Edwards include small arms ranges, training areas, battle positions, observation posts, and maneuver roads and trails (Figure 1). These facilities support a variety of training activities to include small arms training and qualification.

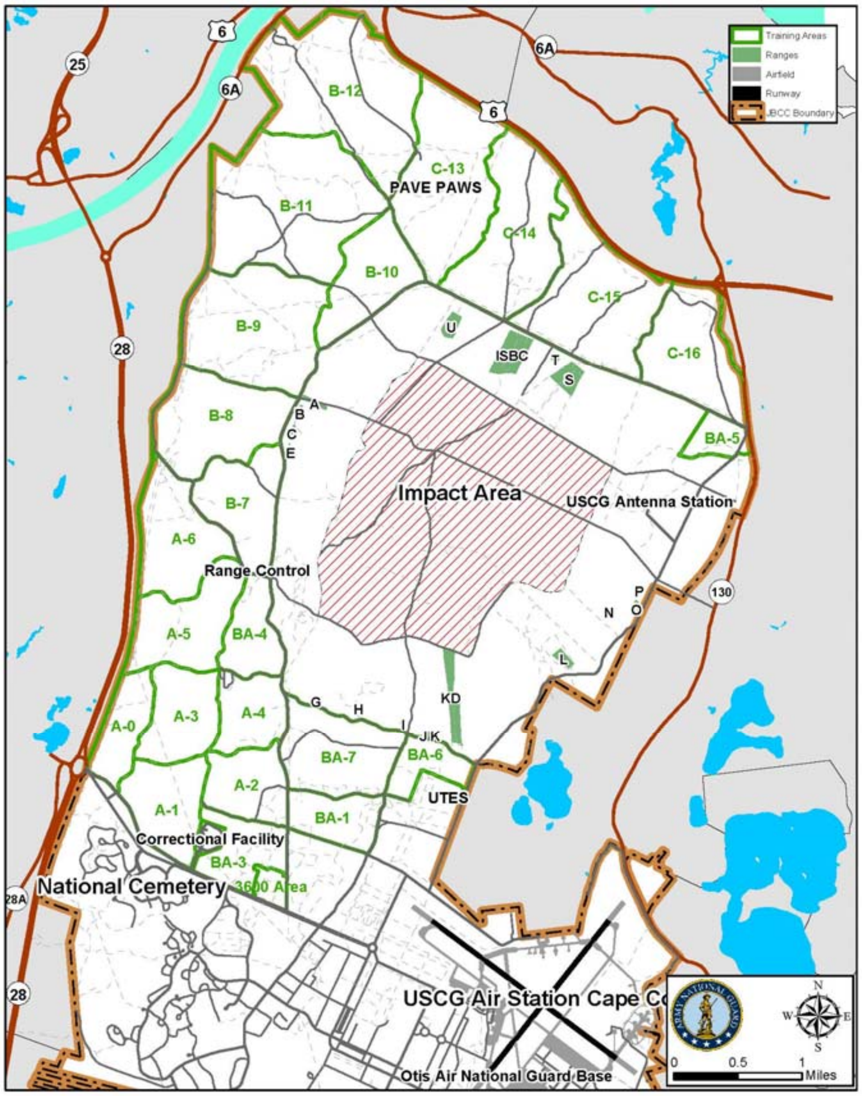

Figure 1. Training Area and Ranges, Camp Edwards, Massachusetts.

In 1997, the use of lead ammunition was suspended at all small arms ranges on Camp Edwards as required by an EPA Administrative Order under the Safe Drinking Water Act (EPA Docket No. SDWA-1-97-1030) (AO2). AO2 explicitly prohibited "all firing of lead ammunition or other 'live' ammunition at small arms ranges at or near the Training Range and Impact Area." AO2 also provided for a process to return to live firing at the small arms ranges (see Paragraph 125 of AO2). The following sections present an explanation why MANG believed a modification to authorize a limited pilot project under the conditions specified was both "necessary and appropriate" under AO2.

In cooperation with the SARWG, the MANG selected Tango Range, an existing small arms range, to receive the STAPP™ system for the Department of the Army demonstration/validation program. Subsequently, Juliet and Kilo Ranges were proposed for use, and funding for STAPP™ systems on these ranges was provided by Congress. Tango, Juliet, and Kilo Ranges were previously-used small arms ranges. Prior to STAPP™ installation, soil on these ranges was sampled and any required mitigation was conducted by the IAGWSP. On June 13, 2007, the MANG requested that the EPA modify the Scope of

Work (SOW) to Administrative Order SDWA I-97-1030 ("AO2") issued pursuant to Section 1431(a) of the Safe Drinking Water Act with respect to the Massachusetts Military Reservation (MMR) (currently Joint Base Cape Cod). On July 23, 2007, EPA responded to this request by adding Appendix B to AO2, which authorized limited firing of lead ammunition at Tango Range through December 2008 and required the MANG to submit to EPA a final report after the conclusion of that pilot project. In January 2009, EPA further modified AO2 by adding Appendix C to the order, which extended the authorization to fire lead ammunition at Tango Range through December 2009 and to allow firing at two additional small arms ranges, Juliet and Kilo.

Soils with pre-existing small arms range contaminant constituents, primarily lead and nitroglycerine, were removed from the reconfigured ranges prior to STAPP™ system installation. An earthen berm was constructed and/or reconstructed on the ranges to receive the STAPP™ systems (Figure 2). On Kilo Range a new berm was constructed to be in line with the berm on Juliet Range so that both ranges could safely be used concurrently. The STAPP™ system was installed on Tango Range June through July 2006 and on Juliet and Kilo Ranges June through September 2008.

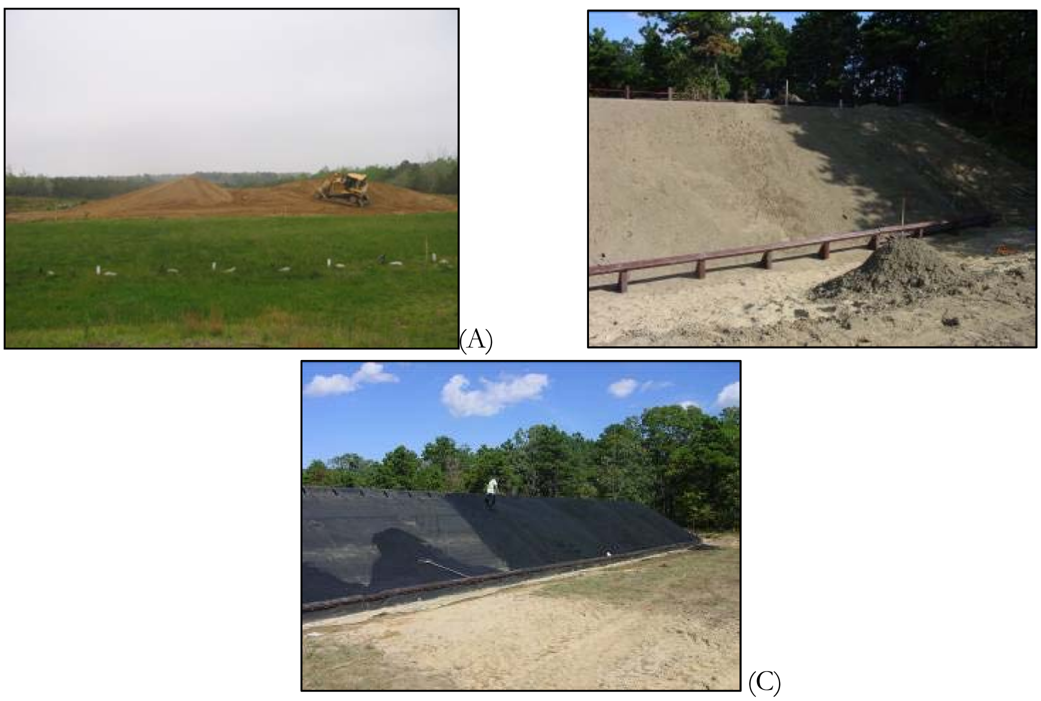
(A) (B) (C)

Figure 2. Tango (A), Juliet (B), and Kilo (C) Range Site Work and STAPP System Construction Camp Edwards, Massachusetts.

TANGO RANGE

In 2006, as part of the Department of the Army (DA) demonstration/validation testing program on bullet containment systems, a granulated rubber bullet trap system, the STAPP™ bullet containment system, was shipped to Camp Edwards in the spring of 2006. The program goal was to assess how effective the bullet trap system could be in managing tungsten-nylon ammunition, the then-proposed Army replacement for lead ammunition. Prior to completing the evaluation, tungsten was discovered in groundwater (February 2006). The use of tungsten-nylon ammunition was suspended at Camp Edwards.

Beginning in late 2006, there were numerous public notices published and meetings held with the various advisory groups to keep the public, surrounding towns, and regulators apprised throughout the process of bringing small arms firing back to Camp Edwards. Site visits and an open public tour of the range were conducted.

In 2007, the EMC's Science Advisory Council (SAC) and Community Advisory Council (CAC) unanimously voted in support of the requested changes to the EPSs, which made possible the return to lead firing on Tango Range.

Further information about the need and process to resume firing lead ammunition on Tango Range is available in the Tango Range Pilot Study Report, Massachusetts Military Reservation, Cape Cod, Massachusetts, August 2009.

JULIET and KILO RANGES

In 2007 the MANG initiated action requesting the construction of a STAPP™ bullet containment system at Juliet and Kilo Ranges and resuming firing of lead ammunition at the two ranges. A Notice of Project Change was submitted to the Massachusetts Executive Office of Energy and Environmental Affairs (EOEEA) on July 9, 2007. EOEEA issued a Certificate on August 10, 2007 approving the request and establishing several conditions to ensure maximum feasible environmental protection and adequate public involvement.

In a letter submitted to EOEEA during the public comment period on the Notice of Project Change for Juliet and Kilo ranges, the EMC established a requirement for the MANG to prepare a brief summary status update of lessons learned to date on the current STAPP™ bullet trap system installed on Tango Range, with the update describing how the lessons and experiences from the Tango Range might be applied to the design specifications, construction plans, and construction supervision of the proposed bullet containment systems on Juliet and Kilo ranges. The EMC also required the information in the update to be presented to the SARWG, applicable advisory groups (SAC and CAC), and the public. The status update, Camp Edwards/Massachusetts Military Reservation Small Arms Range Working Group Status Update 2 was published summer 2008. The MANG submitted a request to the EMC on July 10, 2008 requesting permission to construct appropriate berms and the STAPP™ system on Juliet and Kilo ranges. The EMC approved the construction request in a letter dated August 6, 2008.

On September 25, 2008, the MANG submitted a letter to EPA asking it to modify AO2 to allow the resumption of firing lead ammunition at Juliet and Kilo ranges using a STAPP™ bullet trap system. A 30-day public comment period was conducted October 23, 2008 through November 24, 2008. EPA received seven sets of written comments from the public during this period and a total of eleven substantive comments. Comments were primarily supportive of the request. After reviewing the MANG's request, conducting a 30-day public comment period, which included a public meeting, EPA approved the MANG's request on January 28, 2009.

2.0 RANGE DESCRIPTIONS

The STAPP™ system on Tango Range consists of a composite lumber frame approximately 100-feet long by 23-feet wide with 15 firing lanes. On Juliet Range the system is 120-feet long by 25 feet wide with 17 lanes. Kilo Range is 200-feet long by 25-feet wide with 29 lanes. Granular rubber was placed on top of the bottom-liner inside the composite frame to a depth of 18 inches. The granular rubber was then capped with a patented "self-closing" top cover. The bullets pass through the top cover and are captured in the granulated rubber layer. This system is designed to capture and contain fired bullets. The system also minimizes potential airborne lead and runoff. The system includes an internal water collection reservoir to capture any water that infiltrates the STAPP™ system. The MANG built and placed toe berm boxes at the base and in front of the systems to protect the framing and water reservoir of the STAPP™ systems from projectiles (Figure 3).

Figure 3. Toe-Berm Boxes, Tango Range, Protecting STAPPTM system Base and Internal Reservoir, Camp Edwards, Massachusetts.

On Tango Range tension lysimeters designed to sample soil pore water for potential contaminants were installed in front of the firing line and between the target line and STAPP™ system. Three lysimeters were installed at a depth of five feet below the ground surface near the target line and three were located at the firing line. In 2008 it was determined that tension lysimeters can provide false sampling results because the materials that they are composed of may bind or release other contaminants. All tension lysimeters were replaced with pan lysimeters that are not known to have the same issue with contaminants seen in tension lysimeters. Three pan lysimeters were installed on Tango Range in 2010 (Figure 4). Each of these is essentially a plastic bucket with a screened lid to allow percolating water into the bucket. Tubes provide access to the collected water which is pumped to the ground surface for sampling. The screens are all placed approximately 2 feet below the ground surface. There is one pan lysimeter in front of the firing line, one in the center of the range floor and one between the target frames and the STAPP™ system.

Three pan lysimeters were installed on Juliet Range in 2010 (Figure 5). The screens are all approximately 2 feet below the ground surface. There is one pan lysimeter in front of the firing line, one at the center of the range floor and one at the west end of the drainage swale between the toe boxes and the STAPP™ system.

Four pan lysimeters were installed on Kilo Range in 2010 (Figure 6). The screens are all approximately 2 feet below the ground surface. There is one pan lysimeter in front of the firing line, one at the center of the range floor and one at each end of the drainage swale between the toe boxes and the STAPP™ system.

Background lysimeters were installed in the area of Kilo, Sierra and Tango Ranges to provide a comparison between porewater conditions on and off the small arms ranges so that the potential impact of small arms firing can be discerned from natural conditions.

In 2016 the EMC's SAC recommended spilt core soil sampling to replace lysimeter use for tracking initial metals movement through soils. Split core soil sampling will be implemented when all agency approvals are received.

To monitor ground water conditions on the STAPP™ ranges monitoring wells were installed to intercept groundwater flow from water that originated from the ranges. The wells were installed by the IAGWSP and are now used to monitor potential contaminants in groundwater at the active STAPP™ Ranges.

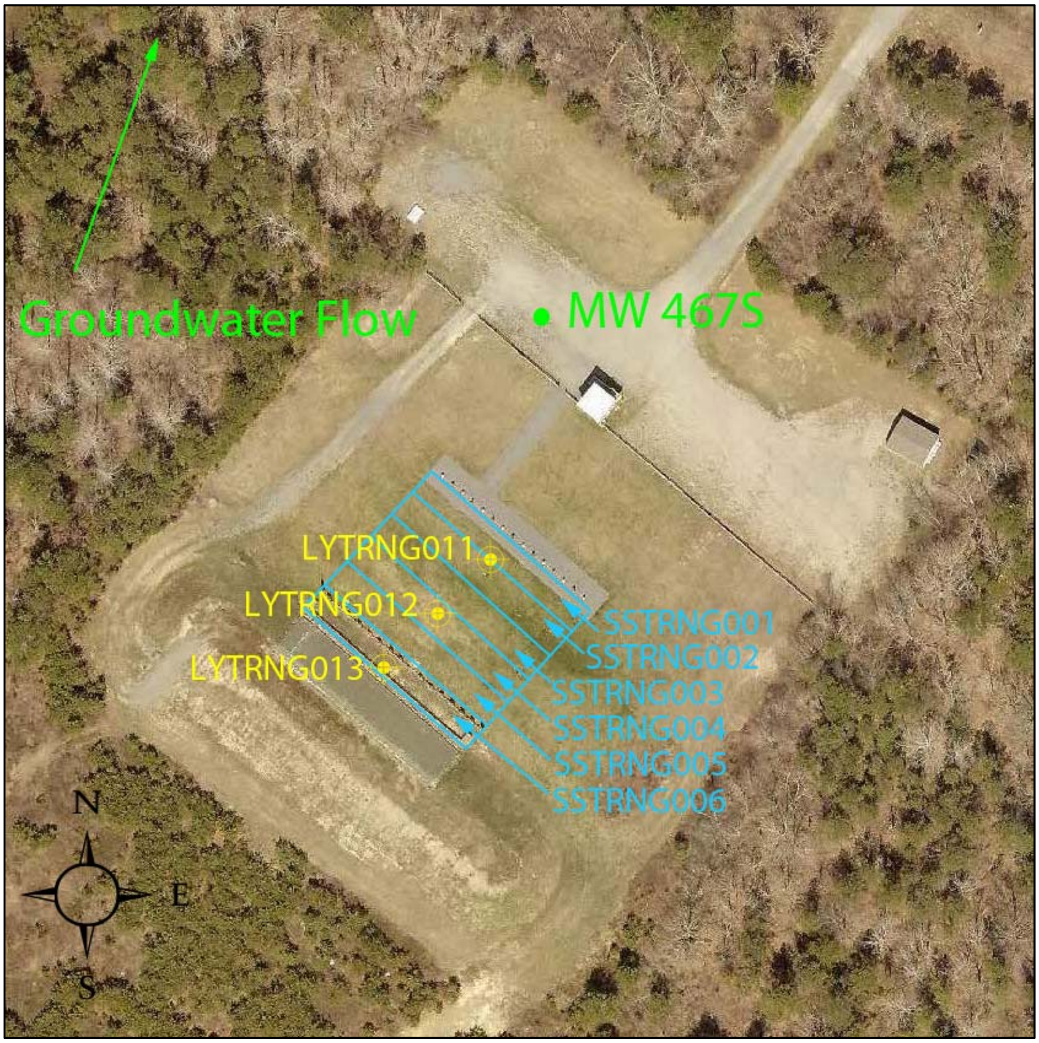

Figure 4. Lysimeters, Soil Grids, and Monitoring Well on Tango Range Camp Edwards, Massachusetts.

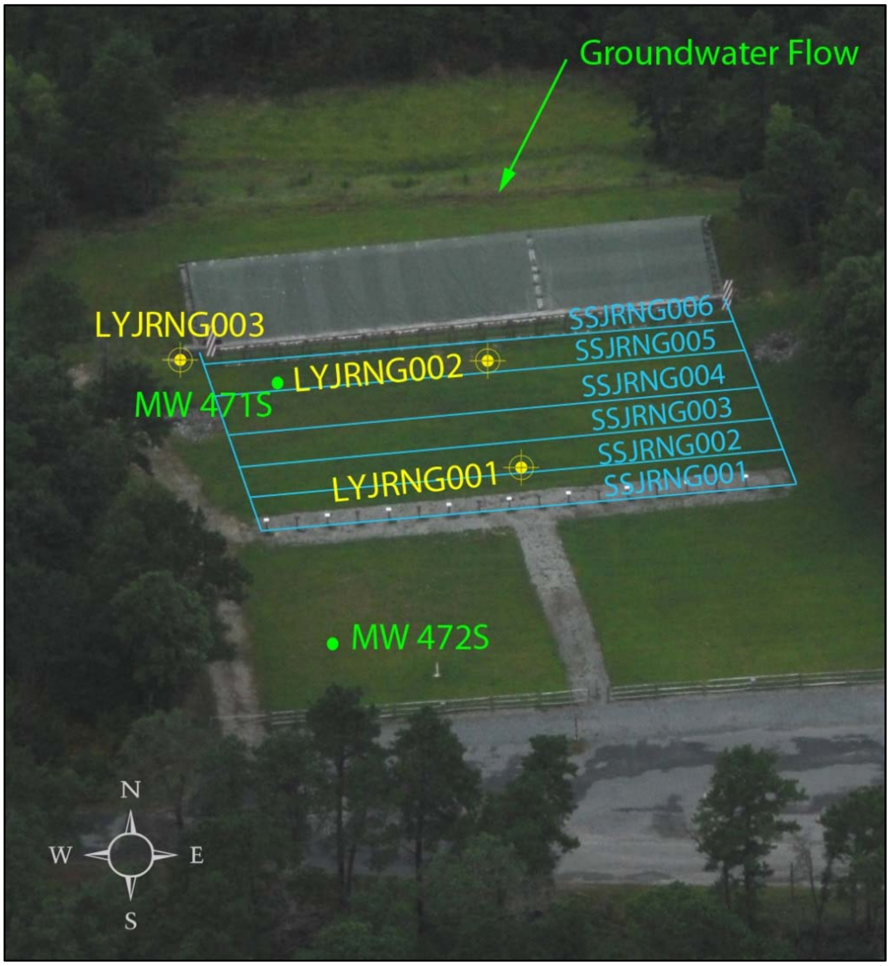

Figure 5. Lysimeters, Soil Grids, and Monitoring Well on Juliet Range Camp Edwards, Massachusetts.

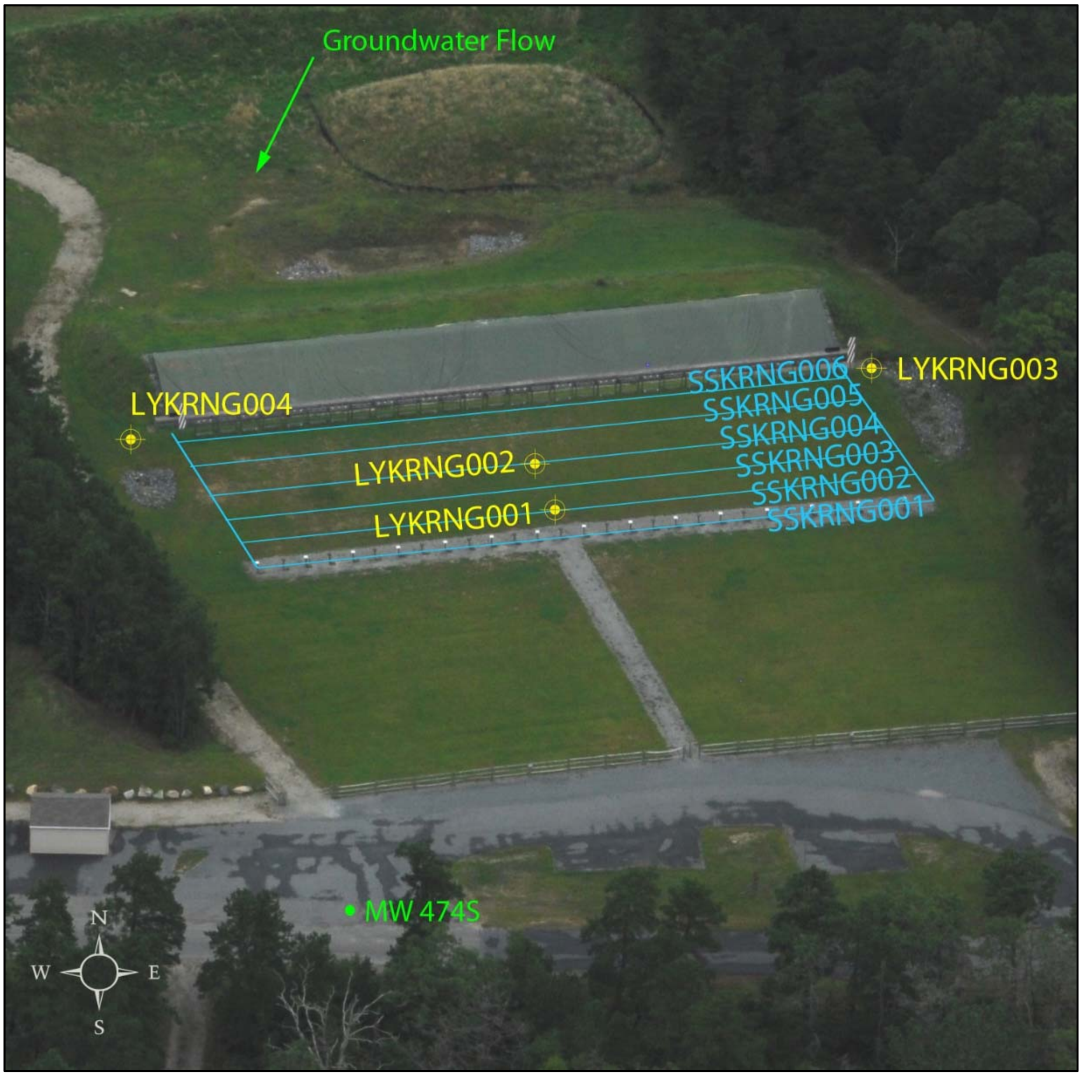

Figure 6. Lysimeters, Soil Grids, and Monitoring Well on Kilo Range Camp Edwards, Massachusetts.

2.1 INITIAL STAPP™ EVALUATION AND FIRING DEMONSTRATIONS

The Tango Range STAPP™ system was structurally evaluated in August and September 2006 prior to any test firing. It was noted that there appeared to be seam failures in the cover, possibly caused by improper gluing techniques. The seams were reported to and repaired by the STAPP™ EBC Company in October 2006. Two firing demonstrations were held during 2007, with approximately 1,700 rounds of 5.56mm lead ammunition fired into the system. The demonstrations showed that the bullets were generally contained within the first three inches of the granular rubber medium. The top cover performed per the manufacturer's literature. During both demonstrations, there was no indication of rounds ricocheting; the target frames and the toe boxes were inspected and there was no evidence of errant rounds.

As part of the initial evaluation, the water collection reservoir inside the STAPP™ system was checked periodically to monitor how much water was collecting. Water collection became a management issue for the STAPP™ systems and is discussed in Section 5.4. The overall quantity and analytical results for water removed from the STAPP™ systems are presented in Section 5.4. There were no validation tests for Juliet and Kilo Ranges as the test at Tango Range served this purpose for STAPP™ system use on Camp Edwards. Juliet and Kilo Ranges also had issues with water collecting within the system that exceeded what was expected by the manufacturer. The water issue at Juliet and Kilo Ranges was not as significant as that at Tango Range but still became an undesirable maintenance and management issue.

3.0 RANGE USE HISTORY

Range users consisted of MANG (Army and Air), U.S. Coast Guard (USCG), Army Reserve units, and various law enforcement agencies and personnel (Figure 7).

Detailed records are kept by Range Control as to the rounds fired, type of round and the lane used. The Army and National Guard are required to track ammunition usage for accountability of resources and to document small arms range throughput (utilization) in accordance with AR 350-19, The Sustainable Range Program. For safety purposes live ammunition usage by specific type must be maintained in various Range Control logs and is a requirements of the OMMP.

Figure 7. Soldiers from the 182nd Infantry Firing at Juliet Range.

The operational firing results for this report cover March 2007 through December 2015. There were two demonstrations at Tango Range in March and April 2007 and 58 operational firing events over the course of its formal Pilot Period, August 2007 through December 2008. Tango Range was used 125 days and Juliet and Kilo Ranges were used for 150 days each since the ranges became operational. As of the end of Training Year 2015 (September 30, 2015), 1,121,332 rounds have been fired on the STAPP™ ranges. The number of rounds fired per range is: 323,331 on Tango Range, 296,599 on Juliet Range, and 499,282 on Kilo Range. The types of ammunition fired were: 5.56mm, 9mm, 40cal, 7.62mm, 2.23cal, 45cal, and 38cal. Out of the total rounds fired: 68.5% were 5.56mm, 21.4% were 9mm, 7.0% were 40cal, 1.2% were 7.62mm, 0.78% were 2.23cal, 0.67% were 45cal, and 0.03% were 38cal. Tables 3-1 to 3-3 provide the number and types of lead ammunition fired on the ranges.

Table 3-1 Lead Ammunition Use History, Tango Range

Training Year	.40 Cal Lead	9 mm Lead	7.62 mm Lead	5.56 mm Lead	.38 Cal Lead	.45 Cal Lead	.233 Cal Lead	Total
2015	0	5,240	0	1,720	0	0	0	6,960
2014	0	0	0	3,220	0	0	0	3,220
2013	1,600	1,800	0	2,000	0	0	4,550	9,950
2012	2,800	7,373	0	1,944	0	0	0	12,117
2011	5,200	6,765	0	25,157	0	0	0	37,122
2010	40,341	2,496	0	41,042	0	6,449	0	90,328
2009	0	31,985	0	105,077	300	0	0	137,362
2008	4,075	9,094	4,556	0	0	0	0	17,725
2007	0	0	0	8,547	0	0	0	8,547
Total	**54,016**	**64,753**	**4,556**	**188,707**	**300**	**6,449**	**4,550**	**323,331**

Table 3-2 Lead Ammunition Use History, Juliet Range

Training Year	.40 Cal Lead	9 mm Lead	7.62 mm Lead	5.56 mm Lead	.38 Cal Lead	.45 Cal Lead	.233 Cal Lead	Total
2015	2,500	24,828	0	36,938	0	1,000	0	65,266
2014	2,400	18,874	9,000	6,663	0	0	0	36,937
2013	2,450	9,260	0	27,286	0	0	1,200	40,196
2012	750	12,819	0	14,457	0	0	3,000	31,026
2011	0	16,911	0	46,630	0	0	0	63,541
2010	0	7,311	0	27,060	0	0	0	34,371
2009	0	4,780	0	11,482	0	0	0	16,262
2008	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0	0
Total	**8,100**	**94,783**	**9,000**	**170,516**	**0**	**1,000**	**4,200**	**287,599**

Table 3-3 Lead Ammunition Use History, Kilo Range

Training Year	.40 Cal Lead	9 mm Lead	7.62 mm Lead	5.56 mm Lead	.38 Cal Lead	.45 Cal Lead	.233 Cal Lead	Total
2015	0	15,601	0	54,372	0	0	0	69,973
2014	0	31,304	0	49,052	0	0	0	80,356
2013	0	731	0	73,011	0	0	0	73,742
2012	0	7,181	0	52,731	0	0	0	59,912
2011	14,362	9,850	0	100,942	0	0	0	125,154
2010	1,450	7,500	0	51,412	0	0	0	60,362
2009	0	6,675	0	23,108	0	0	0	29,783
2008	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0	0
Total	**15,812**	**78,842**	**0**	**404,628**	**0**	**0**	**0**	**499,282**

As a requirement of the Tango Range OMMP, the MANG conducted a mass balance of bullets contained in the STAPP™ system. The mass balance was conducted to assess a percentage of rounds captured by weight, measuring the weight of rounds fired versus the weight of the metal collected from the system. The mass balance provides a known percentage of the calculated weight of the bullets fired versus the weight of material recovered that has been contained and not introduced into the environment. This information was reported in the 2009 Pilot Period Report.

The normal objective of the routine bullet pocket maintenance is simply removal of accumulated rounds. Accumulated rounds can be a ricochet hazard to the top cover over time. The maintenance process is done to reduce the overall top cover maintenance requirement. A mass balance on a STAPP™ system had never before been attempted and the weight measurements taken cannot, by the very nature of the materials involved, be a perfectly precise exercise.

An extrapolation approach was used based upon bullet pocket removals within each lane. The bullet pockets in each lane represent the greatest concentration of projectiles in the STAPP™ system. Under normal circumstances the recommended maintenance for bullet pockets is done every three years or 500,000 rounds, but in this case it was determined to perform the manufacturer-recommended maintenance early, in conjunction with the mass balance measurement requirements of the OMMP.

Additionally, two lanes (Lanes 14 and 15) were selected for complete removal of all rubber granules that would be sifted and sorted to obtain projectiles to be weighed (Figure 8). This weight allowed for the extrapolation across the range of the rate of capture of projectiles fired into the STAPP™ system.

Figure 8. Tango Range Lanes 14 and 15, Sorting and Sifting Operation during Mass Balance Work, Camp Edwards, Massachusetts

The rubber granules were returned to the STAPP™ system following the removal and inspection (Figure 9).

On November 17, 2008, the sifting operation began. The sifting process was interrupted after the work was underway due to improper site preparation. As a result of this initial change, it was unknown if Lane 14 was effectively isolated while being screened. Measurement of hot spots was then continued with lanes 13, 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2, and 1. It is believed that Lane 14 and 15 bullet pockets were combined during the screening process.

Per the Range Control documented summary of rounds fired, and the individual weights of the types of bullets that were fired, the total weight of spent rounds in Lanes 14 and 15 for the test period is calculated to be 108.45 lbs. compared to a measured weight of 102.49 lbs. This will be discussed in detail at the end of this section.

The actual recovered weight from the complete lane sifting of Lanes 14 and 15 was 68.50 lbs. in Lanes 14 and 15 plus the previously removed bullet pocket weight of 32.00 lbs. The bullet pocket weight is labeled Lane 14, but there is a high probability this includes Lanes 14 and 15 due to the interruption of the bullet pocket measurement. As stated previously, the STAPP™ system has no internal lane divisions.

As an additional check, a 2,000 lb. sample of granular rubber from Lanes 14 and 15 was not returned to the system after the complete lanes sifting and weighing event. This sample volume was subsequently resifted and missed bullets were captured and weighed. The weight of the spent bullets was 0.272lb for this sample volume. To extrapolate the missed spent bullets and fragments found in the resifting exercise of the granular rubber sample from Lanes 14 and 15, the following equation was used:

Weight of spent bullets from resifting			Sample of rubber from Lanes 14 and 15			Rubber weight per lane			Lane 14 and 15			Additional weight of spent bullets from the resifting of Lanes 14 and 15	
0.272	lbs.	/	**2000**	lbs.	X	**7333**	lbs.	X	**2**	lanes	=	**1.99**	lbs.

It is expected that some of the bullets have been pulverized into very small fragments by hitting other bullets/fragments, etc. and would not be possible to account for in this particular procedure.

To determine the total lbs. of weight recovered from Lanes 14 and 15 during the bullet pocket cleanup, complete lane sift and resift of the 2,000 lbs sample, the following equation was used:

Bullet Pocket weight lane14 and likely lane 15			Weight of spent bullets from lane 14 and 15 not including bullet pocket weight			Extrapolated weight from above from resifting lane 14 and 15			Total spent bullets recovered from Lanes 14 and 15	
32.00	lbs.	+	**68.50**	lbs.	+	**1.99**	lbs.	=	**102.49**	Lbs.

Figure 9. Tango Range Lanes 14 and 15, Re-Installing Rubber Granules after Mass Balance Work, Camp Edwards, Massachusetts

Compared to data on weight of total rounds fired per the Range Control log (102.29 lbs./108.45 lbs.) = 94.3%.

Given the inherent difficulties of the field measurement and the precision of some of the measurements, roughly 94% agreement can be considered excellent for this mass balance exercise.

A possible better indicator of system performance than weighing the bullet pockets is an evaluation of the under and overshot data. A visual inspection shows some bullet holes in the overshot wall and toe berm boxes. There are relatively few overshot and these decrease with height. This pattern was readily seen on the plywood overshot wall above the STAPP™ system. This is perhaps a more realistic estimate of system efficiency, i.e. number of rounds fired from Range Control records, less number of bullet holes in plywood and toe box, divided by total number fired.

Over and undershot have been closely monitored. Individual bullet holes have been marked, dated and counted in the toe berm boxes and plywood overshot wall. The percentage (%) of rounds that were over and undershot is calculated at 0.5% per the discussion below. Based on over and undershot data, and assuming no bullets are being purposefully shot high or low, and the known quantity of bullets fired, the recovery rate of the STAPP™ system is calculated to be over 99%.

Range Control personnel thoroughly inspected the toe berm boxes and reported finding 392 bullet holes for the period March 2007 through November 2008. The toe berm boxes have been in place for the entire Pilot Period firing. The calculated percentage of low shots is 0.316% (392 holes/123,787 total rounds fired).

Range Control personnel also inspected the overshot wall above the STAPP™ system and reported finding 187 bullet holes. The wall was erected during the week of February 11, 2008. Calculating the percentage of high shots using the number of rounds fired from the wall erection date to the end of the period, shows 0.183% (187 holes/101,916 rounds fired Feb 11 – Dec 31 2008). The calculated percentage of rounds not contained in the STAPP™ system is 0.5% (619 high and low rounds detected/123,787 total rounds fired). Using the above calculations of bullet holes above and below the STAPP™ system, roughly 99% of the rounds fired were likely contained in the STAPP™ bullet trap. Using this metric, the MANG considers the range configuration highly successful in terms of bullet containment and environmental protection.

From both methodologies it is expected that the STAPP™ system and its supporting components are successful in capturing and containing from 94%-99% of the projectiles fired at the system.

The vast majority of bullets fired on Tango, Juliet, and Kilo Ranges are contained in the STAPP™ system. It has been observed that a small percentage of rounds fired do not make it into the STAPP™ system. The major causes for rounds not penetrating the STAPP™ are rounds ricocheting off target frames and Soldiers firing too high or low, referred to as overshot or undershot. Undershot bullet holes have been found in the toe berm boxes at the base of the system and overshot has made holes in the wood wall above the original Tango Range STAPP™ system. Ricocheting rounds, or those aimed too high, may also hit near the upper edge of the STAPP™ system and "skip" back out of the system. An auxiliary berm to the STAPP™ system berm that extended above the top of the system was originally part of Tango Range when constructed in 2006. It had provided some overshot detection and protection, but was removed as part of the search for the source of water that was entering the STAPP™ system during the 2007 reconstruction effort. In order to evaluate and monitor overshot above the STAPP™ system, a four-foot high plywood wall was installed in February 2008, at the top of the berm after the original top of the berm was removed (Figure 10). The intent was not to capture the ricochets or overshot but to assess a possible percentage of rounds that were not being captured in the STAPP™ system.

A red stripe was painted on the upper portion of the top cover on all STAPP™ ranges to limit overshot (Figure 11). The red line provides for an upper limit of aiming for all range users. This has greatly reduced impacts to the STAPP™ system above the red upper limit line.

Figure 10. Plywood Overshot Telltale Wall, Tango Range, Camp Edwards, Massachusetts.

Figure 11. Red Line, Upper Limit of Aiming to Decrease Overshot, Juliet Range Camp Edwards, Massachusetts.

As part of the Tango Range Pilot Period and as discussed above, an alternative metric of bullet containment was used and a mass balance evaluation was also conducted to identify the percentage of rounds captured within the system. During the mass balance and inspection activities, it was noted that the bottom-liner between Lanes 6 and 7 was perforated by several 7.62mm rounds. The penetrations were investigated by recovering the bullets (Figure 12). The bottom-liner was repaired by STAPP™ and Range Control personnel. The exact cause of the 7.62mm bullet penetrations in these two lanes is not known. It can be speculated that the depth of rubber granules was not sufficient at the location of the penetrations and could be caused by repeated use of the lane by machine gun fire (M240B, 7.62mm). The bottom-liner under the "bullet pocket" of all 15 lanes was inspected during the mass balance work and no penetrations were found other than Lanes 6 and 7. The original OMMP accounted for the potential of penetrations in the bottom-liner and the MANG followed the appropriate procedures: they notified regulators, recovered the rounds, repaired the bottom-liner, and returned to training. To further lower the probability of penetrations, approximately two tons of additional granular rubber material was added during the top cover replacement performed in July 2009.

In general, results of inspections of Tango, Juliet, and Kilo Ranges during the Pilot Period show that the STAPP™ system, when properly operated and maintained, functions to contain bullets, sever exposure pathways and protect the environment.

Figure 12. Bottom Liner Penetrations and Recovered Rounds, Tango Range Camp Edwards, Massachusetts.

4.0 RANGE OPERATIONS, INSPECTIONS, MAINTENANCE, AND MODIFICATIONS

The following sections discuss how the STAPP™ ranges are operated, the maintenance and modifications performed, and range inspections conducted by the MANG, EPA, and the EMC. During the Pilot Period, several modifications to the original range configurations were implemented. All range modifications were discussed and approved at the SARWG meetings and through required regulatory processes. The OMMP has also been modified to reflect changes that were identified and approved.

4.1 RANGE OPERATIONS

Camp Edwards Regulation TAGMA PAM 350-2 outlines extensive rules and procedures for the ranges and training lands on Camp Edwards. The OMMP in sections 4.0 and 7.0 (Appendix A) also outlines extensive rules and procedures for the ranges on Camp Edwards. Range Control personnel are well-versed with these regulations and educate Range Safety Officers (RSOs) during the scheduling and issuance of ranges to using units. Camp Edwards personnel oversee and assist the training conducted on Juliet, Kilo, and Tango ranges and evaluate whether training is conducted in accordance with operational, safety, and environmental requirements. Before occupying Juliet, Kilo, or Tango Range, the unit must designate an RSO who will receive a safety briefing. The briefing informs units of the installation's restricted areas, misfire and malfunction procedures, communication procedures, and environmental considerations such as minimum and maximum firing distances and aiming below the red line painted on the upper portion of the STAPP™ systems.

Range Control is responsible for the oversight of Juliet, Kilo and Tango range operations. They issue and clear the ranges and monitor units on Juliet, Kilo and Tango ranges to support compliance with the OMMP. The Camp Edwards Environmental Office and Range Control schedule all required monitoring and maintenance.

To ensure continuity of operations during military staff transitions, Range Control has hired a civilian range control person. This positions job will be to learn all aspects of range operations, help in directing staff to manage the ranges and again to ensure continuity during military staff transitions.

In accordance with the OMMP, each unit is responsible for completing the Training Facility Utilization Report in Appendix A of the OMMP (Appendix A). This form documents who uses the facility, how many personnel were trained, what they did, the quantity of rounds fired and other information important for tracking the use of the facilities. Each Report is turned in to Range Control at the end of each training day. This information feeds into the detailed inspection log maintained by Range Control. An important aspect of ensuring compliance with the OMMP was communicating and coordinating with personnel using the ranges. Range Control personnel were active in educating users of the specific OMMP requirements in order to maintain compliance.

Over the course of the Pilot Period and as standard practice, Range Control maintains a detailed log for each firing event. Data recorded from each event includes, but is not limited to: unit firing, officer in charge, temperature, weather, the time when the range went hot and cold, and the particular type of round fired on each lane. These records allow the user to query the data by the number of rounds and type fired on each lane.

4.2 RANGE INSPECTIONS

Tango, Juliet, and Kilo Ranges have been the focus of extensive inspections during the Pilot Period (Appendix A). The MANG (Range Control and the E&RC), EMC's Environmental Officer, EPA and MassDEP have all performed inspections before, during and after training events.

The ranges are inspected periodically as described below to ensure that pollution prevention equipment remains in place and is in good working order and to ensure that environmental conditions on the ranges are not degrading.

Before each time a range is used for live firing, a range inspection is conducted by Range Control accompanied by the Non-Commissioned Officer in Charge (NCOIC) or person in charge of the group using the range. This provides a chance to document pre-firing conditions and to acquaint the range users with the facilities and the expectations associated with range use. The inspection includes the firing line, range floor, target line, STAPP™ system, and other important features of the ranges. The parking areas are inspected for general condition and any petroleum, oil, and lubricant stains from vehicles. The toe berm boxes behind the target frames are evaluated to identify deterioration, damage or excessive amounts of undershot. Range Control and range users note the condition of each of these features and any specific deficiencies in need of repair.

The ranges are inspected again after range use is complete to document the post-firing conditions (Figure 13). The form provided in the OMMP (Appendix A) is used to document the pre- and post-range firing inspections and to note any changes or discrepancies.

Figure 13. Tango Range Top Cover Inspection, Range Control Camp Edwards, Massachusetts.

Monthly inspections consist of general range conditions, evaluation of erosion, surface water, vegetation growth, and a visual inspection of the STAPP™ system. Range issues were documented, reviewed with appropriate personnel and addressed by Range Control. Inspections identified issues with the STAPP™

system structure, systems that protect the STAPP™ system, and the administrative record. The following provides several examples of issue identified during inspections.

The toe berm boxes at Juliet and Kilo Ranges were degrading and becoming a major maintenance issue. The box bottoms were collapsing with the protective sand infill spilling from the box. Interim repairs were made by filling the toe berm boxes with sand bags until new boxes could be placed on these ranges. All toe berm boxes on Juliet and Kilo Ranges have been replaced.

Penetration holes, rips greater than 1.5 inches in length with rubber media visible through the rubber membrane cover, and seam failures have been found at the STAPP™ Ranges. Repairs are made prior to subsequent range use. However, there are times where problems identified could not be immediately addressed--most often as a result of weather conditions and or availability of materials. Repairs were made when the weather allowed and orders were made to provide for materials needed to repair the system.

Finally, it was identified that the administrative record was not in order. Issues identified included Utilization Inspection Reports that did not consistently record the requested information; the most up-to-date detailed inspection form and range inspections/clearance checklist were not being used, and these forms did not consistently record the requested information. Also, some post-fire inspections were not recorded, and it was not clear that maintenance was conducted based upon the results of each inspection. Administrative record issues were rectified by meeting with Range Control staff to ensure all current forms are used and, most importantly, that all issues identified and repairs are recorded in the record.

Range Control conducts Detailed Range Inspections monthly. Detailed Range Inspections are also completed within two business days of significant storm events. These inspections determine the condition of pollution prevention equipment and general range conditions. In particular, the conditions of the STAPP™ system and any protective cover are closely monitored. The amount of water accumulated in the STAPP™ system is measured and recorded. The form provided in the OMMP (Appendix A) is used to document the Detailed Range Inspections. During the Detailed Range Inspection conducted each year in March, Range Control takes baseline condition photos every third year of the firing lines, range floors, soil berms, and bullet containment systems while standing at firing positions 4 and 13. These and previous baseline photos help field crews evaluate observed conditions against the baseline and help document the rehabilitation of any reported range deterioration using the baseline condition photos and any rehabilitation photos. This photo log is maintained at Range Control.

The conditions inside the STAPP™ system are inspected and documented when the STAPP™ cover is removed for maintenance and/or during periodic bullet removal. Typically, this is done after 500,000 rounds have been fired on Juliet and Tango Ranges and after 750,000 rounds at Kilo Range unless it is determined in conjunction with the regulatory agencies that removal is not needed. This inspection can also be conducted more frequently if conditions warrant. The form provided in the OMMP (Appendix A) is used to document the detailed STAPP™ inspections.

The internal STAPP™ system was qualitatively assessed in the spring and again in early summer 2016 in support of a Scope of Work development for metals removal from the Juliet Range STAPP™ system. The bullets were observed to be contained within the top 8-12 inches of the system. Consequently, it was determined that the rubber granule material and any contained lead bullets will be removed selectively from the system. The portions of the system containing the greatest concentrations of lead bullets will be disposed of off-site as hazardous waste. New rubber granule material will be added back to the system, and those portions removed from the top and bottom of the system will be re-installed to the same areas in which they were removed. This action is scheduled to be conducted during the summer of 2016. After the rubber granule material is removed, the bottom underlayment, ground liner, and wooden frame will be inspected for damage.

The EMC and EPA have conducted unannounced independent inspections of Juliet, Kilo, and Tango ranges as needed. All personnel, including regulatory personnel, check in with Range Control prior to visiting the ranges. If inspections occur during range use, the inspector identifies themselves to the person in charge at the range and follows all safety procedures and requirements of the range users. EPA and EMC provide the inspection form to Range Control for inclusion in the inspection record. To ensure that all deficiencies identified during an inspection are addressed, Camp Edwards provides a formal response to inspection reports submitted by regulatory agencies within five business days.

Range Control maintains all the inspection logs with hard copies placed in a binder and archived. Range Control compiles data into a table that tracks the maintenance performed, level of effort to perform the maintenance, and supplies required to conduct maintenance. The primary maintenance conducted as a result of the inspection process is patching or seaming the STAPP™ system top cover and removal and disposal of water collected within the STAPP™ system internal reservoir. In an effort to reduce the amount of water accumulating within the system, tarps were placed over the top covers in 2010. Water within the reservoirs of the STAPP™ systems has become less of an issue after the installation of tarps over the STAPP™ systems when not in use (Figure 14). A summary of inspection table can be found within the OMMP (Appendix A).

Figure 14. Tarp Covered STAPP™ Systems at Juliet and Kilo Ranges Camp Edwards, Massachusetts.

EPA issued a letter on March 15, 2011 notifying Camp Edwards of a failure to notify EPA of level 1 and 2 interim action level exceedances and the fact that resampling did not occur as required. On May 3, 2011 the EPA issued a letter notifying Camp Edwards of a failure to comply with the Safe Drinking Water Act through AO2 and its modified SOW to allow for the interim use of Tango, Juliet and Kilo Ranges. Camp Edwards did not comply with the OMMPs for these ranges. Camp Edwards did not sample soil, porewater, and groundwater and did not report the findings as required. Another letter was issued to Camp Edwards on November 7, 2011 for failure to follow the provisions of the approved OMMPs for the above mentioned violations and additionally for not disposing of water that accumulated in the STAPP™ systems on Tango, Juliet and Kilo ranges above established limits within 72 hours and for not notifying EPA within 24 hours that this required action could not be completed.

The EMC also issued a Notice of Violation letter to Camp Edwards on November 7, 2011 informing it that it had not complied with the Small Arms Range EPS (EPS 19) in failing to remove liquid from the STAPP™ bullet capture systems on Tango, Juliet and Kilo ranges on multiple occasions in 2011 within the time period established in the OMMP plans. Camp Edwards submitted a Response Packet to the EPA and EMC in early December 2011.

As a result of these violations, and after extensive consultations, Camp Edwards was fined by EPA $27,500 in August 2012 and also agreed, through a Consent Agreement and Final Order on August 16, 2012 (Appendix D), to conduct a Supplemental Environmental Project (SEP). The project involved removing 14 acres of existing impervious surfaces in the grasslands area of the Cantonment Area, most of it located on Otis Air National Guard Base. The 14 acres were left to seed naturally from the surrounding environment. This allows for native flora to establish itself within the grassland area. It also allows for further recharge of the aquifer by removing impervious surface area. The area will be monitored for invasive plants species and managed to control the density of native pitch pine that can act like an invasive species by growing into a monoculture that is not beneficial to the goal of grassland restoration.

Project status reports on the removal of the 14 acres of impervious surface were submitted to EPA on November 5, 2012, January 10, 2013 and May 7, 2013, with a final report submitted on October 12, 2013 notifying EPA of the project's completion.

As a result of this violation, and as proposed in the Response Packets, the MANG submits a Monthly Report on the status of the STAPP™ Ranges to EPA and also provides it to the EMC. Monthly Sustainable Range Program meetings were also proposed and are being conducted to ensure proper awareness, communications, and management of the STAPP™ and other ranges is occurring. The Response Packet also addressed communications, notification protocols, and that proper funding for STAPP™ range management was in place.

4.3 RANGE MAINTENANCE AND MODIFICATIONS

Camp Edwards conducts periodic maintenance on Juliet, Kilo, and Tango ranges to ensure design features and pollution prevention measures remain in adequate condition to support training requirements and ensure that the BMPs function as intended. To the maximum extent possible, maintenance is conducted during off-peak training periods (between October and April). This preventative maintenance is conducted as needed, regardless of other maintenance schedules.

All maintenance and repairs conducted on Juliet, Kilo, and Tango ranges are documented using a Range Maintenance/ pH testing/Lime Spread Form in the Appendix C of the OMMP (Appendix A) and then filed in the maintenance log at Range Control.

The majority of site maintenance consisted of patching and seaming the STAPP™ system top cover. Other maintenance activities consisted of pumping and disposing of water collected in the STAPP™ system reservoir and grounds keeping.

A range modification was made based on a request by the USCG to utilize the range for transition or reflexive firing training, the OMMP was reviewed to ensure it was protective during this type of use with respect to firing lines, firing lanes, weapons, ammunition types, and target placement. With respect to the firing lines, the reflexive firing training requirement is to fire from several different distances from the target line, between three to 25 yards. In October 2007, the USCG conducted a dry-fire demonstration so members of the SARWG could observe and understand the training aspects of transition firing. To further support this training requirement, the MANG established a maximum and minimum firing distance from the target line along the range floor. The maximum firing distance is 25m, and the minimum firing distance is 2.7m. The maximum and minimum distances are within the Surface Danger Zone (SDZ) for the bermed range and are within the capabilities of the STAPP™ system. The current design and construction of STAPP™ could support rounds fired directly on the upper membrane without compromising the integrity of the trap; however, weapons training does not authorize or require point blank firing at the STAPP™ system.

At Tango Range pre-existing elevated machine gun mounds located behind the firing line were knocked down, as they served no useful purpose. During the week of April 19, 2008, the mounds were knocked down and used to raise the height of the 25 meter firing line by approximately two feet, creating an improved angle of fire that decreases overshot.

Range floor drainage was an issue on Juliet and Kilo Ranges. The lack of adequate drainage on this range was threatening the integrity of the base of the STAPP™ system and Soldiers were forced to conduct their training by laying in the water to fire on the range. In 2010, a project was initiated and completed that re-graded the range floor and installed drainage systems to correct this issue on Juliet and Kilo Ranges.

An additional modification to Tango Range was the installation of a wooden plywood wall located above the STAPP™ system on the berm. The wall was installed to help evaluate how many rounds fired high may be missing the STAPP™ system. A broad red stripe was placed near the top of the STAPP™ systems on Juliet, Kilo, and Tango Ranges to aid in preventing overshot at these ranges. The stripe provides the shooter with a visible mark to avoid aiming the weapon above this stripe thereby helping to prevent overshot.

Prior to full-scale training, initial checks on the STAPP™ systems showed that larger than expected amounts of water was collecting inside the systems. To help assess potential causes of the water collection, a detailed dismantling and inspection of the Tango Range STAPP™ system was planned prior to full-scale training on the range. The STAPP™ contractor deconstructed the system in July 2007. Just prior to dismantling the system, an additional 300 gallons of water was removed.

As part of the inspection process, the system was taken apart and all aspects of the construction were reviewed: the framework was intact, the bottom-liner was not ripped or perforated, the depth of rubber granules was correct, and the top cover did not have any visible holes other than the above-mentioned seam failures/tears. However, it was noted that there was some silt inside the center section of the system. The moist silt indicated a potential mechanism or pathway for the excess water entering the STAPP™ system. The silt and water may have entered the STAPP™ system by flowing between the bottom-liner and the top cover where they are attached to the frame at the highest point of the system. To remedy this potential cause of water infiltration, the apex of the earthen berm extending higher than the Tango Range STAPP™ system was removed to reduce the amount of precipitation running down and over the face of the STAPP™ system. Additionally, a minor modification was made to the method of securing the bottom-liner and top cover to the frame along the top edge of the system. The bottom-liner of the system was free of any bullet holes, and the 1,700 bullets fired during the demonstrations were contained within the rubber granular medium.

Overall, the system appeared to be installed correctly with the exception of concerns that the original gluing of the seams was not done in strict compliance with recommendations of the glue manufacturer. The STAPP™ system was re-constructed with a new bottom-liner as the original bottom-liner was damaged when the system was dismantled. As an additional protective measure, a felt fabric material was placed between the soil and the bottom-liner. The original rubber granules and top cover were used and the re-constructed Tango Range STAPP™ system was made available for small arms range training in August 2007.

On Juliet and Kilo Ranges water within the system was also an issue but not to the extent that occurred at Tango Range. Like Tango Range, all aspects of the systems were checked and were found to be sound in their structure and function. During the spring of 2015 STAPP™ EBC came to Camp Edwards to try and remedy the water collection issue at Juliet and Kilo Ranges. Their efforts included removing and replacing framing members while tightening the top cover and placing bottom liner material from the top of the system to the ground behind the system. In theory it was to shed water from running under the system or between the bottom liner and the top cover. The repair was not successful in reducing the amount of accumulating within the system. To remedy water build up on all STAPP™ ranges the STAPP™ systems were recovered with tarps to protect from precipitation. This action proved to be extremely effective in reducing the water issue with the STAPP™ systems. Water is still found within the reservoir but not the volumes seen before the using traps to cover the STAPP systems. Table 4-1 shows pumped STAPP™ system water prior to and after tarps were used to cover the STAPP™ systems.

Table 4-1. Pumped STAPP™ System Water, Before and After Tarps Were Installed, JKT Ranges, Camp Edwards, Massachusetts. (*Tarps installed September/October 2011)

Training Year	Tango Range	Juliet Range	Kilo Range
2007	1,420	--	--
2008	1,870	--	--
2009	4,570	0	0
2010	700	130	140
***2011**	2,465	815	1,545
2012	115	62	128
2013	8	70	155
2014	115	100	71
2015	480	630	95
Total	**11,743**	**1,807**	**2,134**

Another modification to the STAPP™ systems was the incorporation of a view/extraction port for the internal water collection reservoir (Figure 15). Initially, the internal reservoir was only accessible by unbolting and peeling back the top cover. Range Control installed an external port to allow for the viewing and removal of collected water. The riser pipe was extended and a round hole was cut into the top cover, a sealed rubber boot was applied and top cap was installed. This modification saves time and effort in evaluating the internal water collection reservoir. This modification was implemented at Tango, Juliet, and Kilo Ranges. The port on Tango Range is located in the lower right hand corner facing the system, on Juliet Range it is in the lower left hand corner, and on Kilo Range there is a port at both the lower right and left hand sides of the system.

Figure 15. STAPP™ System internal Reservoir Access Port Tango Range, Camp Edwards, Massachusetts.

5.0 ENVIRONMENTAL MONITORING RESULTS

Camp Edwards monitors surface soils, pore water, and groundwater at Juliet, Kilo and Tango ranges on a rotating schedule (Appendix A) for the metals antimony, copper, and lead. There is a potential for these metals to occur and move within the environment after projectiles that are fired onto the range are oxidized, abraded, and further exposed to the environment. The goal of the monitoring is to determine when range maintenance activities are needed to protect the environment and promote range sustainability. Data validation is completed at the Tier I[1] and Tier II[2] level for all data. Ten percent of the data is validated at the Tier III level. Unvalidated (i.e. draft) data is forwarded to the regulatory agencies within two business days of receipt by the MANG.

The results of sampling are compared to the action levels presented in Table 5-1. Any increase in concentrations are noted in the results submittal. If an unexpected result exceeds an Action Level, resampling may be conducted to confirm the result. Any concentrations exceeding the action levels are noted in the results submittal and a proposed plan for re-sampling, if needed to confirm an exceedance, is included pending data validation. Validated data is forwarded to the regulatory agencies as soon as feasible within seven business days of receipt. Validated data is normally received by the MANG 4-6 weeks after sampling occurs.

Action Levels for contaminants associated with small arms firing were established for soil, porewater, and groundwater based upon comments from the SARWG and members of the SAC. Initially (May 2007), there were two levels for porewater and groundwater and one level for soil. The matrix of Action Levels was simplified such that there is currently one action level for each potential contaminant (antimony, lead, copper) for each sampling media (soil, porewater, and groundwater). With approval from the EPA and the EMC, tungsten, zinc, and nitroglycerin are no longer part of the analysis. For tungsten, the source area at each range where tungsten bullets were used was removed so that further sampling for tungsten on the STAPP™ ranges was no longer required. As for nitroglycerin, a study was conducted in 2010, Adsorption/Desorption Measurements of Nitroglycerin and Dinitrotoluene in Camp Edwards, Massachusetts Soils. This study found that unfired and fired propellant tests suggest that nitroglycerin and dinitrotoluene is not completely available for dissolution, and tests with weathered soils indicate none of the nitroglycerin is available, although analysis shows nitroglycerin is still present in the soil. Therefore it was found that nitroglycerin was not a threat to the groundwater and was no longer needed to be analyzed for at the STAPP™ ranges.

The surface soil action levels for lead, copper, and antimony are set using selected concentrations from the Massachusetts Contingency Plan. These values are not necessarily directly applicable to active small

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[1] Tier I Data Validation will include a general review of sample receipt, analysis, and the ability of the instruments to recover the elements or compounds that were analyzed. The main components of a Tier I Data Validation include: assessing the technical holding times, surrogate recoveries, matrix spike/matrix spike duplicates, laboratory control samples, and method blanks.

[2] Tier II Data Validation will include all of the parameters assessed during the Tier I Data Validation as well as the following parameters: Metals (6010C and 6020A): Mass spectrograph tuning; initial calibration; Continuing calibration; internal standards; Target compound identification. Tentatively Identified Compounds (TICs): TICs will only be addressed in Tier II Data Validations and are generally evaluated only for ground water recovery results. Initial and continuing calibration; Duplicates; Metals spikes and LCS recovery; Assessment of Interferences; Mass tuning (6020A). These parameters primarily deal with instrument calibration and analysis sensitivity. Additionally, Tier II Data Validation includes several methods that are not, or are only generally, addressed in the Tier I Data Validation Checklist.

arms ranges, but they provide a framework for comparison to concentrations that are considered potentially hazardous in some situations. Porewater action level numbers are based on drinking water standards because the porewater is monitored as an early warning of potential groundwater impacts. Drinking water standards are not applicable to porewater but they provide a framework for comparison to concentrations that are potentially hazardous if they were to migrate all the way to the aquifer. Groundwater action levels are set equal to one half of the drinking water standard because a detection of range-related metals in groundwater at these concentrations would indicate a potentially significant and unexpected occurrence and response actions should be taken before concentrations exceeding safe drinking water concentrations occur. The current Action Levels are summarized in Table 5-1.

Table 5-1. Current Action Levels for Soil, Porewater, and Groundwater
Camp Edwards, Massachusetts.
Surface Soil

Action Levels			
	Lead	**Antimony**	**Copper**
Surface Soil	3,000 mg/Kg	300 mg/Kg	10,000 mg/Kg
Porewater	15 ug/L	6 ug/L	1,300 ug/L
Groundwater	7.5 ug/L	3 ug/L	650 ug/L

5.1 SOIL SAMPLING RESULTS

Soil analytical results are discussed in detail in the Annual Environmental Sampling Reports (Appendix B). All soil analytical results collected during the Pilot Period are summarized in those reports.

The soil sampling at Juliet, Kilo, and Tango Ranges is performed using an incremental sampling methodology (ISM) from six sample areas on each range on alternating years. The sample areas are laid out in strips across the width of the ranges from the firing lines to the backstop berms so that the impact of metals deposition at the firing lines, the target areas, and the areas in between could be separately quantified (Figures 4, 5, and 6).

One hundred-point composite samples are collected from each sample area from a depth of 0 to 3 inches below ground surface (bgs). All samples are ground and processed in accordance with EPA Method 8330B. Soil samples are currently analyzed for antimony, lead, and copper. Table 5-2 provides the maximum lead concentrations detected on Juliet, Kilo, and Tango Ranges since 2010. See Annual Environmental Sampling Reports for specific sampling data (Appendix B)

Table 5-2. Maximum Lead Concentrations (mg /Kg) Detected in Soil on Juliet, Kilo, and Tango Ranges
Camp Edwards, Massachusetts.

	OCT-10	MAY-11	OCT-11	SEP-12	JUL-13	AUG-14	AUG-15
Juliet Range	54.6	192	106	43.3	Not Sampled	58.4	Not Sampled
Kilo Range	28.2	30	35.5	Not Sampled	28.1	Not Sampled	34.4
Tango Range	1090	522	439	Not Sampled	351	Not Sampled	98.9

These values represent the maximum lead concentrations detected in the six soil sampling areas on each range floor. No consistent trends are apparent in the data at Juliet or Kilo ranges which indicates that lead concentrations are not increasing with continued use of the ranges. However, at Tango Range there is a decreasing trend in the maximum concentration of lead within the sampling areas. This trend may be a result of the lack of deposition and the adsorption of lead to soil at Tango Range. During the nine year pilot period no Action Levels for soil have been exceeded at Tango, Juliet, or Kilo Ranges.

5.2 POREWATER RESULTS

Porewater analytical results for Tango, Juliet, Kilo, and background lysimeters are discussed in detail in the Annual Environmental Sampling Reports (Appendix B). All porewater analytical results collected during the Pilot Period are summarized in the reports.

TANGO RANGE

Only antimony has been detected in porewater at Tango Range at concentrations above the Action Level (Table 5-3). This has occurred on two occasions (August 2014, 2015) at one location (LYTRNG013, Figure 4) at the center base of the STAPP™ system. Lead and copper concentrations remain well below the Action Levels. These detections are further discussed below.

Table 5-3. Antimony in Porewater at Juliet, Kilo, and Tango Ranges with Background Lysimeter Data to Include the Sierra Range Background Lysimeter.

Range	Lysimeter	Oct-10	May-11	Oct-11	Sep-12	Nov-12*	Feb-13*	Jul-13	Aug-14	15-Aug
Juliet	LYJRNG003	0	0	0	**11.4**	**32.8**	**43**	**36**	**54.1**	**70.75**
Kilo	LYKRNG003	0	0	0	**6.9**	**9.6**	**12**	**11.6**	**26.2**	**37.1**
	LYKRNG004	0	0	0	**7**	**12.1**	**15**	**11.5**	**17.3**	**35.7**
BG	LYKRBGD01	-	-	-	-	-	Not sampled	No sample /dry	0.43	No sample /dry
Tango	LYTRNG013	0	0	0	4	*4*	5.1	4.3	**11**	**15.2**
BG	LYTRBGD01	-	-	-	1.5	0.18	0.35	0.074	ND	ND
Sierra BG	LYSRBGD01	-	-	-	-	-	Not sampled	No sample /dry	No sample /dry	0.92

BG = Background
ND = Nondetect
*Resample

JULIET RANGE

Antimony has been detected in one porewater lysimeter (JRNGLY003) at Juliet Range at concentrations above the Action Level (Table 5-3). This has occurred in several sampling events. The location is near the STAPP™ system. Lead and copper concentrations remain below the Action Levels. These detections are further discussed below.

KILO RANGE

Antimony has been detected in the two porewater lysimeters (KRNGLY003 and KRNGLY004) at Kilo Range at concentrations above the Action Level (Table 5-3). This has occurred in several sampling events. These lysimeters are both in the drainage swale near the STAPP™ system. Lead and copper concentrations remain below the Action Levels. These detections are further discussed below.

BACKGROUND LYSIMETERS

In 2012 background lysimeters were installed in the vicinity of Tango and Kilo Ranges. They were installed to provide a comparative data set for the background occurrence in porewater of antimony, copper, and lead. The Tango Range background lysimeter is the only background lysimeter that was able to be consistently sampled since installation (Table 5-4). The Kilo Range lysimeter was only sampled in 2014 as it has been dry during all other sampling events. Although not sampled this cycle, the analysis of four rounds of background porewater sampling near Tango Range indicate antimony concentrations as high as 1.5 ppb, copper as high as 1.6 ppb, and lead as high as 0.53 ppb. At Kilo Range in 2014 porewater sampling indicated antimony concentrations of 0.43 ppb (Table 5-3), copper of 0.79 ppb, and lead of 0.084 ppb. Similar concentrations of these metals detected in lysimeters on the ranges may tentatively be expected to be background concentrations.

Table 5-4. Background Lysimeter Results for Tango Range, Camp Edwards, Massachusetts.

Year	Antimony	Copper	Lead
2012	1.5	1.6	0.079
2013	0.74	1.1	0.13
2014	ND	3.2	0.53
2015	ND	ND	ND

ND = Non-Detect.

The source of the antimony detected in the lysimeters near the firing berms at the three ranges is suspected to be from legacy range soils. At all three ranges, the soils comprising the berms were reshaped from previously used, on-site, range berm soil. The dissolution and movement of antimony may be exacerbated by the phosphate-based soil amendments that were used on and in the original berms to minimize dissolution of and migration of lead during the initial pollution prevention actions under AO2. Research has shown that antimony becomes mobilized in soil in the presence of phosphates.

It should also be noted that on Juliet and Kilo Ranges water runoff is directed from the range berm and floor into a drainage swale(s) thereby concentrating range runoff into a single sampling point. Along with the phosphate amendments, this process could be a contributing factor in concentrating antimony at the sampling points (porewater) which have exceeded the prescribed action level for antimony. Annual monitoring of porewater and groundwater at the ranges will continue including sampling for antimony so that the concentrations can be monitored and groundwater can be protected. Through the recommendation EMC's SAC (Section 6.0) monitoring porewater or the use of lysimeters will be replaced by using split core soil sampling when approved. The SAC voiced that they believe that the use of lysimeters and the results is not representative of how metals are moving through soils. They have stated that there is too much sampling bias; for example water has preferential pathways as it moves through soils along with the potential for the lysimeters themselves to be contaminated with soil material that may be affecting samples due to prolonged contact time.

5.3 GROUNDWATER RESULTS

Groundwater analytical results are discussed in detail in the Annual Environmental Sampling Reports (Appendix B). All groundwater analytical results collected during the Pilot Period are summarized in those reports.

TANGO RANGE

Groundwater beneath Tango Range flows from south to north (Figure 4). Tango Range has one groundwater monitoring well that is sampled annually, MW-467S. Monitoring well MW-467S is north of the firing line in a down-gradient position. The location and screen height of MW-467S was selected to intercept any Contaminants of Concern (COCs) emanating from Tango Range. Monitoring well MW-489S was also sampled in the past; however, it was discontinued for active monitoring under the OMMP because it is located south of the STAPP™ berm in an up-gradient location. Unfiltered groundwater samples are currently analyzed for lead, copper, and antimony using EPA Method SW6020A.

Results from sampling groundwater wells on Tango Range indicate that there are generally no concentrations of lead, copper, or antimony above the action levels in groundwater. The one exception was the 24.1 ppb result from a sample collected from MW467S in 2015. Low water levels within the well necessitated the use of a bailer to retrieve a sample from this well. In accordance with the OMMP the well was resampled and the results were 4.1 ppb for lead which is below the action level for lead in groundwater as set forth by the OMMP. Upon resampling the well still had low water levels but the samplers were able to collect a single sample.

The groundwater metals results obtained during the Tango Range Pilot Period are consistent with conclusions made in a report titled: The Environmental Assessment of Lead at Camp Edwards, Massachusetts Small Arms Ranges, May 9, 2007, Prepared by Jay L. Clausen, Biogeochemical Sciences Branch, U.S. Army Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire (CRREL Lead Report). Conclusions made in the CRREL Lead Report indicate that lead has not migrated to groundwater at any small arms ranges monitored on Camp Edwards including some small arms ranges with decades of training using lead ammunition.

Like other propellants, nitroglycerine was thought to be a threat to groundwater. Groundwater sampling results for propellant related compounds, primarily nitroglycerine, are also consistent with conclusions made the report titled: Adsorption/Desorption Measurements of Nitroglycerine and Dinitrotoluene in Camp Edwards Soil, February 2010, prepared by CRREL. Based on the scientific studies to evaluate the fate and transport of propellants, one of the conclusions of this report states that the groundwater is not expected to be impacted by propellant residue associated with small arms range training. With approval from the EPA and the EMC, nitroglycerin is no longer required to be analyzed for when sampling groundwater at the small arms ranges.

JULIET RANGE

Groundwater beneath Juliet Range flows from northeast to southwest (Figure 5). Juliet Range has two groundwater monitoring wells that are sampled annually, MW-471S and MW-472S. Monitoring well MW-471S is downgradient of the STAPP™ system and MW-472S is downgradient of the range floor and firing line. The locations and screen elevations were selected to intercept any contaminants, primarily lead, antimony, and copper, emanating from Juliet Range. The source of lead and antimony being the projectile and the bullet primer that contains lead styphnate--another source of lead.

Results from groundwater wells on Juliet Range indicate that there are no concentrations of lead, copper, or antimony above the action levels in groundwater.

The groundwater metals results obtained during the Juliet Range Pilot Period are consistent with conclusions made in CRREL lead report.

The groundwater results for propellant related compounds, primarily nitroglycerine, are also consistent with conclusions made in the CRREL nitroglycerine report.

KILO RANGE

Groundwater beneath Kilo Range flows from northeast to southwest (Figure 6). Kilo Range has one groundwater monitoring well that is sampled annually, MW-474S. The location and screen elevation were selected to intercept any contaminants emanating from the range floor and firing line at Kilo Range. Well MW-473S was also previously sampled but was eliminated from the OMMP because it is not located appropriately to monitor for contaminants resulting from the range as currently configured.

As per the OMMP, groundwater samples are currently analyzed for lead, copper, and antimony using method SW6020A. Results from groundwater wells on Kilo Range indicate that there are no concentrations of lead, copper, or antimony above the action levels in groundwater. Samples were also previously analyzed for nitroglycerine and tungsten. In coordination with the regulatory community Tungsten was no longer sampled for as result of source removal at the range.

The groundwater metals results obtained during the Kilo Range Pilot Period are consistent with conclusions made in the CRREL lead report.

The groundwater results for propellant related compounds, primarily nitroglycerine, are also consistent with conclusions made in the CRREL nitroglycerine report.

Studies and data submitted by MANG indicate that the geochemistry of the soil serves to retard the migration of lead, and the depth to groundwater is deep, and substantial intervening soil acts as an absorbent. Data suggests that lead in soil will take a long time to significantly impact the groundwater. The models predict that it could take anywhere from several hundred to over a thousand years for groundwater to exceed drinking water standards. Further, any dissolved form of lead would be rapidly removed from porewater primarily via adsorption processes. Lysimeter results obtained during the Pilot Period support this conclusion as lead levels in porewater have either dropped or have remained consistent through the Pilot Period.

5.4 STAPP™ WATER COLLECTION AND ANALYSIS

During the course of the Pilot Period, water has been collected from the STAPP™ system internal reservoirs at Tango, Juliet, and Kilo Ranges in accordance with the OMMP. This process has resulted in the collection, storage, and disposal of the water according to state and federal regulations and law. Table 4-1 reflects the amount of water removed from the STAPP™ systems to date.

Upon completion of the installation of the STAPP™ system at Tango Range an unanticipated buildup of water was identified in the system. This reoccurring buildup of water was determined to be a result of condensation, as well as infiltration of precipitation into the system. This water was analyzed in March, April, and November 2007 for the MANG by Environmental Chemical Corp. (ECC) under contract with the US Army Corps of Engineers. The results of these sampling events identified the water as non-hazardous, however, elevated levels of antimony and zinc were detected above drinking water limits. In late November 2007, the existing analytical data was reviewed by the 102nd Intelligence Wing Waste Water Treatment Plant (WWTP) manager and the Massachusetts Army National Guard, in coordination with the Massachusetts Air National Guard, successfully introduced 840 gallons to the WWTP for treatment/disposal. Additional accumulated water was sampled in December 2007 by ECC and again in April 2008. The April 2008 analysis, conducted by TMC Services Inc., under Massachusetts Army

National Guard contract, was used to create a waste profile sheet for the disposal of 827 gallons of non-hazardous waste water at an off-site treatment facility in June 2008. In November 2008, the Massachusetts Army National Guard conducted sampling and analysis of the Tango Range STAPP™ water to be included as part of a formal request made to the WWTP to accept all water generated from the STAPP™ system. This request was verbally denied in a meeting with Massachusetts Army National Guard and Massachusetts Air National Guard personnel. In December 2008, using the profile created in June 2008, an additional 2,470 gallons of STAPP™ water was shipped off-site for proper treatment/disposal. It should be noted that before firing occurred at Tango, Juliet and Kilo Ranges the STAPP™ system water analysis showed elevated levels of metals.

In March 2009, the construction of the Kilo Range STAPP™ system was completed and the range came online. In April and June 2009, two additional disposal events for only Tango Range STAPP™ water were conducted, resulting in the disposal of 1,500 gallons and 850 gallons respectively. In August 2009, construction of Juliet Range was completed and by the end of August both new systems had begun to accumulate water resulting from condensation, as well as precipitation. Before the end of August 2009 water was collected separately from Juliet and Kilo ranges and analyzed for Resource Conservation and Recovery Act metals. The results from this sampling event were compared to previous Tango Range results. The August 2009 analysis of water from Juliet and Kilo ranges indicated similar levels of analytes with respect to the previous Tango Range results utilized for off-site treatment and disposal. Therefore, all subsequent off-site treatment and disposal of STAPP™ water from Tango, Juliet, and Kilo ranges, to include January 2010 (1,020 gallons), April 2010 (525 gallons), and December 2010 (1,170 gallons) were shipped off-site utilizing the existing profile sheet generated in June 2008. In 2015, water from the STAPP™ systems was analyzed and found to be consistent with past sampling events where elevated levels of antimony and zinc were found (Table 5-3). Based on the STAPP™ System Water Analytical profiles all STAPP™ water continues to be shipped to an offsite disposal facility as a non-hazardous waste water.

Analytical results for metals were below the MassDEP GW-1 standard and EPA maximum containment levels for all analytes except antimony (Table 5-5). Antimony results range from 13.1 µg/L to 255 µg/L. The MassDEP GW-1 standard and EPA maximum containment levels for antimony are 6.0 µg/L. The waste profile results for the water removed from the STAPP™ indicate that all water removed has been non-hazardous.

Table 5-5. Analytical Results for STAPP System Water, Camp Edwards, Massachusetts.

Sample Identification	Client Project #	Matrix	Collection Date/Time	Received
Range Water SC05514-01	F20-16776	Waste Water	06-Apr-15 10:00	07-Apr-15

CAS No.	Analyte(s)	Result	Flag	Units	*RDL	MDL	Dilution	Method Ref.	Prepared	Analyzed	Analyst	Batch	Cert.
Total Metals by EPA 6000/7000 Series Methods													
7440-22-4	Silver	< 0.0050		mg/l	0.0050	0.0012	1	SW846 6010C	14-Apr-15	15-Apr-15	edt	1506878	
7440-38-2	Arsenic	< 0.0040		mg/l	0.0040	0.0027	1	"	"	"	"	"	
7440-41-7	Beryllium	< 0.0020		mg/l	0.0020	0.0001	1	"	"	"	"	"	
7440-43-9	Cadmium	< 0.0025		mg/l	0.0025	0.0002	1	"	"	"	"	"	
7440-47-3	Chromium	**0.0050**		mg/l	0.0050	0.0010	1	"	"	"	"	"	
7440-50-8	Copper	**0.0189**		mg/l	0.0050	0.0035	1	"	"	"	"	"	
7440-02-0	Nickel	**0.0223**		mg/l	0.0050	0.0014	1	"	"	"	"	"	
7439-92-1	Lead	**0.0292**		mg/l	0.0075	0.0020	1	"	"	"	"	"	
7440-36-0	Antimony	**0.255**	V11	mg/l	0.0060	0.0025	1	"	"	"	"	"	
7782-49-2	Selenium	< 0.0150		mg/l	0.0150	0.0036	1	"	"	"	"	"	
7440-28-0	Thallium	< 0.0050		mg/l	0.0050	0.0016	1	"	"	"	"	"	
7440-66-6	Zinc	**20.6**	GS1, D	mg/l	0.0500	0.0056	10	"	"	16-Apr-15	"	"	
Total Metals by EPA 200 Series Methods													
7439-97-6	Mercury	< 0.00020		mg/l	0.00020	0.00009	1	EPA 245.1/7470A	14-Apr-15	14-Apr-15	YR	1506879	X
General Chemistry Parameters													
	pH	**6.70**	pH	pH Units			1	ASTM D 1293-99B	08-Apr-15 12:00	13-Apr-15 14:08	CAA	1506536	X

The water removed from the STAPP™ system was initially treated at the 102nd WWTP as approved by the MassDEP. Subsequent disposals of the STAPP™ water were and are taken offsite to a licensed recycling facility.

As indicated in other sections of this report, the STAPP™ systems were covered with tarps to limit the amount of water entering the systems. This practice has greatly reduced the amount of water accumulating within the STAPP™ systems.

6.0 ENVIRONMENTAL MANAGEMENT COMMISSION

Through the recommendations of the Community Working Group, the MANG, and through the actions of the Governor and the State Legislature, Chapter 47 of the Acts of 2002 established the EMC, consisting of the Commissioner of the Department of Fish and Game (DFG), the Commissioner of MassDEP, and the Commissioner of the Department of Conservation and Recreation (DCR). The EMC oversees compliance with and enforcement of the EPSs in the Upper Cape Water Supply Reserve/Camp Edwards Training Area (Reserve TA), coordinates the actions of environmental agencies of the Commonwealth of Massachusetts in the enforcement of environmental laws and regulations in the Reserve TA, as appropriate, and facilitates an open and public review of all activities in the Reserve TA. The legislation also states that the environmental agencies of the EMC retain all their respective, independent enforcement authority.

Chapter 47 of the Acts of 2002 also directed that the EMC be assisted by two advisory councils. The CAC, consisting of 15 members, assists the EMC by providing the communities concerns and advice on issues related to the protection of the water supply and wildlife habitat within the Reserve TA. The SAC, consisting of up to 9 members, assists the EMC by providing scientific and technical advice relating to the protection of the drinking water supply and wildlife habitat within the Reserve TA. The Act also established an Environmental Officer for JBCC. In this capacity, the Environmental Officer provides monitoring of military and civilian activities on and uses of the Reserve TA and the impact of those activities and uses on the water supply and wildlife habitats. Working directly for the EMC, the Environmental Officer has unrestricted access to all data and information from the various environmental and management programs in the Reserve TA. The Environmental Officer has full access to all points in the Reserve TA and conducts inspections at any time in order to monitor, oversee, evaluate, and report to the EMC on the environmental impact of military training and other activities. His on-site monitoring occurs prior to, during, and immediately following training and other activities. The Environmental Officer's monitoring activities include but are not limited to: training sites, pollution prevention and habitat protection activities for both military and military contractors in the Reserve TA, as well as coordinating with and consulting with the E&RC on various projects, initiatives, and issues.

The Environmental Officer acts as a liaison between the EMC, SAC, CAC, military, general public, and various state agencies. The Environmental Officer identifies and monitors ongoing issues regarding training procedures and the environment in the Reserve TA and keeps the EMC, SAC and CAC apprised of the progress of these issues in addition to bringing issues to the E&RC for resolution. He also participates in community outreach activities with the E&RC and facilitates the EMC, SAC and CAC public meetings under the legislation.

In general the EMC, SAC, and CAC meet twice a year. However, meetings can be scheduled as needed. The meetings are open to public with meeting notices and agendas provided to the Secretary of State's Office as required under the open meeting law for Massachusetts. These meetings are advertised online at http://www.thenationsfirst.org/ERC/index.htm and ads are placed in the local Enterprise Newspapers. Meeting topics include but are not limited to personnel changes, Natural Resource actions, training area venue and range updates, and finally other Reserve TA activities such as Eversource and National Grid work in the area is briefed.

For small arms range development, the use of simulated munitions (projectile based and pyrotechnic devices) and blank use, the EPSs provide for a rigorous review, management, and oversight process. Currently the EMC's Environmental Officer has oversight of the STAPP™ system ranges (Juliet, Kilo, and Tango Ranges), the Enhanced performance Round (copper) ranges (India and Sierra Ranges), and the M320 40mm grenade range (Lima Range). The following is a summary of the range development process.

Proposed small arms range development, simulated munition (projectile based and pyrotechnic devices) and blank ammunition use on Camp Edwards are regulated by Chapter 47, the Acts of 2002 and its associated EPSs. As the ranges and training aids are proposed for use they are brought before the EMC for evaluation for compliance with the EPSs and compatibility with the habitat and groundwater per the tenants of Chapter 47, the Acts of 2002. In general the proposal is brought to the SAC and CAC for their input and recommendation to the Commissioners that sit on the EMC. If the proposal is supported by the commission then they authorize the Environmental Officer to approve the range in accordance with the EPSs. The Environmental Officer then ensures the tenants of the EPSs are followed to complete the process.

The specific standards are the General Performance Standards and EPS 19. The standards are as follows:

General Performance Standards:

"**Limitations on the use of small arms ammunition and live weapon fire fall into the following two categories:**

> Live weapon fire is prohibited outside of established small arms ranges. Live weapon fire is not allowed on established small arms ranges except in accordance with Environmental Performance Standard 19,other applicable Performance Standards, and a range-specific plan approved through the Environmental Management Commission (EMC).
>
> Blank ammunition for small arms and simulated munitions may be used in areas outside of the small arms ranges, using only blank ammunition and simulated munitions identified on an approved list of munitions. Joint review and approval for inclusion on the list shall be through by the Environmental & Readiness Center (E&RC) and the EMC."

"Pollution prevention and management of the Camp Edwards training ranges will focus on and include the following:

> The Camp Edwards Training Area, including the Small Arms Ranges (SAR) and their associated "Surface Danger Zones," and any areas where small arms or other munitions or simulated munitions are used, shall be managed as part of a unique water supply area under an adaptive management program that integrates pollution prevention, and best management practices (BMP), including the recovery of projectiles. This will be done through individual range-specific plans that are written by the Massachusetts National Guard and approved for implementation through the EMC and any other regulatory agency having statutory and/or regulatory oversight. Adaptive, in this context, means making decisions as part of a continual process of monitoring, reviewing collected data, evaluating advances in range monitoring, design and technology, and responding with management actions as dictated by the resulting information and needs of protecting the environment while providing compatible military training within the Upper Cape Water Supply Reserve.

A range plan shall be designed and followed to reduce the potential for an unintended release to the environment outside of the established containment system(s) identified in the range-specific plans. All users must be aware of, and comply with, the Environmental Performance Standards that are applicable to all SAR activities. Any range specific requirements will be coordinated through the E&RC with the EMC, incorporating those specific requirements into the appropriate range-specific plans and range information packets. Camp Edwards SAR Pollution Prevention Plan shall be followed to prevent or minimize releases of metals or other compounds related to the normal and approved operation of each SAR. The adaptive SAR management program components required in each range-specific plan shall include:

- Consultation with applicable agencies with oversight of the training area before undertaking any actions that are subject to state and/or federal regulatory requirements.

- Specific recovery plans for the removal and proper disposition of spent projectiles, residues and solid waste associated with the weapons, ammunition, target systems, and/or their operation and maintenance.

- Reduction of adverse impacts to the maximum extent feasible, including consideration for the design/redesign and/or relocation of the activity or encouraging only those activities that result in meeting the goal of overall projectile and/or projectile constituent containment. ·

- Internal and external coordination of documentation for the Camp Edwards range management programs and other related Camp Edwards management programs including: the Integrated Training Area Management Program, Range Regulations, Camp Edwards Environmental Management System, Civilian Use Manual, and Standard Operating Procedures.

- Long-term range maintenance, monitoring and reporting of applicable parameters and analysis.

The Massachusetts National Guard shall ensure that all training areas where munitions or simulated munitions are used or come to be located, including range areas, range surface danger zones, and any other areas within the Upper Cape Water Supply Reserve that are operational ranges are maintained and monitored following approved management plans that include planning for pollution prevention, sustainable range use and where applicable, restoration."

EPS 19. Range Performance Standards:

"19.1. All operational ranges including but not limited to small arms ranges (SAR) shall be managed to minimize harmful impacts to the environment within the Upper Cape Water Supply Reserve. Range management at each range shall include to the maximum extent practicable metal recovery and recycling, prevention of fragmentation and ricochets, and prevention of sub-surface percolation of residue associated with the range operations. Camp Edwards shall be held responsible for the implementation of BMPs by authorized range users, including collection and removal of spent ammunition and associated debris.

19.2. Small arms ranges shall only be used in accordance with approved range plans. These plans shall be designed to minimize to the maximum extent practicable the release of metals or other contaminates to the environment outside of specifically approved containment areas/systems. Occasional ricochets that result in rounds landing outside of these containment areas is expected and every effort to minimize and correct these occurrences shall be taken. Failure to follow the approved range plans shall be considered a violation of this EPS.

19.3. All operational SARs shall be closely monitored by the Massachusetts National Guard to assess compliance of the approved range plans as well as the implementation and effectiveness of the range specific BMPs.

19.4. Camp Edwards / Massachusetts National Guard Environmental and Readiness Center shall staff and request appropriate funding to support its SAR management plans.

19.5. All users must use and follow Camp Edwards' Range Control checklists and procedures to:

- Minimize debris on the range (e.g. shell casings, used targets)
- Minimize or control residues on the ranges resulting from training (e.g., unburned constituents, metal shavings from the muzzle blast)
- Ensure the range is being used for the designated purpose in accordance with all applicable plans and approvals

19.6. Camp Edwards is responsible for following range operation procedures and maintaining range pollution prevention systems. Range BMPs shall be reviewed annually for effectiveness and potential improvements in their design, monitoring, maintenance, and operational procedures in an effort to continually improve them. Each year the annual report shall detail the range-specific activities including, but not limited to, the number of rounds fired, number of shooters and their organization, and the number of days the range was in use. The annual report will also detail active SAR groundwater well and lysimeter results, as well as any range maintenance/management activities that took place that training year and the result of such activities, i.e. lbs. of brass and projectiles recovered and recycled, etc. The Massachusetts National Guard shall provide regular and unrestricted access for the EMC to all its data and information, and will provide immediate access to environmental samples from the range, including range management and monitoring systems and any other applicable activities operating on the ranges.

19.7. Range plans and BMPs for training areas shall be reviewed and/or updated at least every three years. Management plans for new and upgraded ranges shall be in place prior to construction or utilization of the range. Range plans, at a minimum, will address long-term sustainable use, hydrology and hydrogeology, physical design, operation, management procedures, record keeping, pollution prevention, maintenance, monitoring, and applicable technologies to ensure sustainable range management. Range plans shall be integrated with other training area planning processes and resources.

19.8. The Massachusetts National Guard shall establish procedures for range maintenance and where applicable, maintenance and/or clearance operations to permit the sustainable, compatible, and safe use of operational ranges for their intended purpose within the Upper Cape Water Supply Reserve. In determining the frequency and degree of range maintenance and clearance operations, the Massachusetts National Guard shall consider, at a minimum, the environmental impact and safety hazards, each range's intended use, lease requirements, and the quantities and types of munitions or simulated munitions expended on that range."

See Appendix C for a complete version of Chapter 47 of the Acts of 2002 and the Environmental Performance Standards.

7.0 CHANGES TO THE OPERATIONS, MAINTENANCE AND MONITORING PLAN AND LESSONS LEARNED

It is acknowledged that the OMMP should be a “living document,” one that changes over time as more information becomes available, technology advances, and lessons are learned. Initially the OMMPs for Tango, Juliet, and Kilo Ranges were separate documents. All STAPP™ Range OMMPs (Tango, Juliet, and Kilo) have been combined into a single document. To illustrate the adaptive and dynamic nature of the OMMP as a living document, revisions to the OMMPs for Tango, Juliet, and Kilo Ranges occurred on June 2007, December 2007, October 2008, and January 2009. The OMMPs were consolidated into a single document in September 2012. The OMMP was again updated April, June, October, and November 2014. Finally the OMMP was updated and approved again in July 2015.

Several major changes to the OMMP include: establishing Interim Action Levels for contaminants in soil, porewater, and groundwater, establishing corrective actions if Action Levels are exceeded, and defining the communications and providing for continuity as personnel leave and are replaced. Specific changes to the OMMP included the following: consolidation of the three plans into one plan for all three ranges; deletion of extraneous information that is not related to protection of the environment; reorganization of the plan so that important tasks have their own primary section and aren’t buried in various sub-sections making the document more user friendly; simplification of the range inspection procedures; streamlined environmental monitoring that accounts for lessons learned since the original OMMPs were written, while still ensuring protection of the environment, and, finally, a simplified action level process for soil, porewater and groundwater monitoring results to ensure environmental protection.

For soil the initial action level was based on the modeled potential for leaching to groundwater and if exceeded, required sample validation, resampling, cause evaluation and potentially the alteration of the conceptual site model. The current action level is based on the Massachusetts Contingency Plan. Initially for porewater and groundwater there were two action levels, a level 1 and a level 2. These levels were based on the relative drinking water standard. For porewater if the action level 1 was exceeded a Focused Reassessment was called for where resampling, modification of the conceptual site model, or maintenance could occur. If a level 2 action level was exceeded for porewater then some sort of Range Maintenance was required such as soil removal, resampling, and a ceasefire until the issue could be rectified after coordinating with regulatory stakeholders. For groundwater there was also a level 1 and 2 action level. The difference between the porewater and groundwater action levels is in the level 2 process. For groundwater if the level 2 action level was exceeded then a cease fire was imposed, stake holder coordination took place, and finally, range maintenance and a reassessment of the pollution prevention program would have been required. Currently there is only one action level for porewater and groundwater. For porewater the level is based on the drinking water standard and for groundwater it is one half the drinking water standard. If action levels are exceeded for these standards stakeholder coordination and resampling is required. Communications and continuity among and with staff was identified as an issue that could be problematic with long-term management of the STAPP™ ranges. Actions taken toward this end were the creation of a reporting matrix, Figure 12-1 of the current OMMP (Appendix A).

Inspection checklists were revised to incorporate SARWG suggested improvements. Sections B and C of the checklists were combined for added clarity and the sketch was appropriately updated to show the placement of the toe berm boxes. Other changes included adding further written directions within the sheets such that day to day users could understand what was expected within each form.

Another change consisted of establishing maximum (25m) and minimum (2.7m) firing distances from the target line along the range floor to facilitate transition firing. This allowed personnel to move forward of the 25m firing line and fire at targets. With the increased area available for firing and potential deposition of contaminants, the soil sampling plan was modified to include six sampling units instead of the original two.

The OMMP now references a red stripe that was painted on the upper portion of the top cover on all STAPP™ ranges to limit overshot (Figure 11). The red line provides for an upper limit of aiming for all range users. This has reduced overshot and impacts to the STAPP™ system above the red upper limit line.

As expressed in Sections 5.2 and 7.3, pan lysimeters are thought to be a better tool for monitoring porewater. The MANG revised the OMMP to require all pan lysimeters on the ranges.

The MANG is committed to keeping the OMMP updated to allow efficient and appropriate operations and monitoring of the STAPP™ Ranges. The MANG will continue to make changes as needed, are appropriate, and approved.

Based on observations and use of the STAPP™ systems there have been lessons learned. The lessons learned have been discussed with members of the SARWG and incorporated in the most current version of the OMMP as required and approved. The lessons learned included are grouped into three categories: Operations, Inspections and Maintenance, and Environmental Monitoring.

7.1 OPERATIONS

Management Controls

The MANG has developed management controls to support compliance with the Small Arms Range OMMPs. Incorporating these management controls into the OMMP would allow the Revised Combined OMMP to act as an overall operating guide and provide built-in redundancy and ensure safeguards are in place, see Section 12 of the current OMMP (Appendix A)

In 2011 management controls that were added to the OMMP that included: 1) a Notification Protocol should the MANG not be able to comply with a requirement of the OMMPs; 2) a STAPP™ Range Tarp Cover Project Description where the STAPP™ systems are covered with a tarp to reduce water build up within the STAPP™ system; 3) Water Removal Contracting and Budgeting provisions to ensure funding is available to dispose of the STAPP™ water and to conduct annual environmental sampling as required; 4) creation of a Camp Edwards Sustainable Range Program Working Group that meets monthly to ensure the OMMP is being complied with and to discuss other Camp Edwards range issues and future range development; and 5) a Standard Operating Procedure for STAPP ™System Range Maintenance Procedures and Inspections.

In order to better understand the time and effort to accomplish routine maintenance on the STAPP™ system, Range Control kept an ongoing log of personnel and time required to perform maintenance. Over the duration of the Pilot Period, it is estimated that patching and/or seaming maintenance work required two personnel an average of four hours per training event. It was noted that as training activities increased so did the required level of effort to properly maintain the top cover.

At the beginning of the Pilot Period, routine maintenance was expected in the form of top cover patching. Repetitive seam failures and frequent water removal were not anticipated (beyond routine maintenance) that could potentially expose personnel to lead residue from spent rounds inside the STAPP™ system. The risk of exposure from opening a corner of the system to remove the excess water was reduced when a water inspection port was installed, allowing staff to conduct OMMP-required water level inspections and remove water from the system without removing the STAPP™ system top cover (Figure 9). Because of the frequency and scale of repairs during the first year of operations at Tango Range, a worker health study was coordinated through the MANG Safety Office to determine if personnel were at risk of exposure to lead and to determine the appropriate level of protective equipment required during maintenance activities. Results of the worker health study identified that personnel were not at risk, and typical health and safety practices such as no eating and drinking during maintenance activities and washing hands before eating were sufficient to protect personnel performing maintenance tasks on the STAPP™ system.

Ricochets have not caused problems to the system or personnel.

On Tango Range raising the 25-meter firing line improved the angle of firing for training and reduced the number of overshot.

The toe berm boxes appear to function well in protecting the base of the STAPP™ system from bullet penetrations. The placement of the toe boxes behind the target frames and within two to three feet of the STAPP™ system allows easier and safer access to the targets and provides greater protection of the framework from errant or ricochet rounds. In 2015 and 2016 the toe berm boxes were replaced at Juliet and Kilo Ranges respectively. The replacement boxes were constructed in a similar fashion to those that have been used on Tango Range. The Tango Range boxes were constructed using 6” x 6” timbers and have been very affective in protecting the base of the STAPP system from undershot.

The Tango Range top cover was replaced due to incorrect installation causing multiple operational issues, e.g. seam failure and water build up.

Rounds can ricochet off of the ground surface, toe boxes, and target frames and tumble entering the system. Tumbling projectiles can cause larger than expected holes in the top cover. This in turn causes greater maintenance.

Hollow point bullets need to be cleared with Range Control and require greater maintenance as they cause larger holes similar to tumbling rounds.

Tracer rounds were demonstrated to function acceptably within the STAPP™ system. Wear and tear above acceptable levels was not observed during demonstrations and inspections with tracer rounds. However on Tango Range there was an instance where tracer rounds bounced back towards the firing line. Range Control has since had a moratorium on using tracer rounds on STAPP™ ranges. Those wanting to use tracer rounds must coordinate with a Range Control Officer before they are approved for use at the STAPP™ system ranges.

Based on lane sampling and extrapolation approximately 94-99% of all rounds fired at the STAPP™ system are captured.

As discussed in Section 3.0, seven 7.62mm rounds penetrated the STAPP™ system bottom-liner. The lessons learned with regards to the 7.62mm rounds is that regular maintenance is critical. The granular rubber depth at 18 inches must be maintained and is crucial to using larger caliber weapons (7.62mm) and to avoid bottom-liner perforations on STAPP™ system small arms ranges. Though a few rounds did penetrate the bottom-liner, and they were recovered, the soil area below the STAPP™ system is not exposed to weathering conditions; thus it is expected that there was no risk to the environment.

Target frames and each firing lane should be located such that the center of each target is lined up on the center of an appropriate panel of the STAPP™ top cover. It is better to have bullets go through the middle of a top cover panel than to cause extra stress on seams between panels.

Inspection and management of the water collecting inside the STAPP™ system was also an ongoing task. Removal of the collected STAPP™ system water generally required two personnel from Range Control an average of three hours per event. Rain event inspections generally required one individual an average of one hour per event. The effort for water collection and monitoring is significantly less since Range Control started the use of tarps to cover the STAPP™ systems. By covering the STAPP™ systems water accumulation within the STAPP™ systems has been significantly reduced, Table 4-1.

Finally, Camp Edwards has hired a civilian Range Control employee to ensure consistency during transition of military and civilian staff. This position's job will be to learn all aspects of range operations, help in directing staff to manage the ranges, and to ensure continuity during military staff transitions.

7.2 INSPECTION AND MAINTENANCE

Initially, bi-weekly inspections were conducted as part of the ongoing training cycle. Inspections are now monthly per an approved change in the OMMP.

All maintenance work on the STAPP™ system should be done with appropriate containment, personal protective equipment and training for site workers.

Walking on the top cover can put pressure on the panel seams and potentially cause seams to fail. Not a current issue.

In the early stages of the program, the top cover patches were square. It was determined through inspections that the lips of the patches were collecting water along with sand. Range Control began designing round or oval patches to allow water and windblown sand to migrate down the face of the STAPP™ system. Top cover repairs now consist of using only glue when possible to fill cuts, slashes, and some holes. Patches are still required where using only glue is not sufficient for repair.

It was found that the product (Loctite 401) used by STAPP™ personnel to glue the seams did not hold up to weather conditions at Camp Edwards. Camp Edwards has found that Loctite 5510 elastic adhesive caulking is the best way to repair holes and seam failures.

Results of air sampling during the bullet sifting activities performed showed that respirators were not required.

Covering the STAPP™ systems with tarps precludes most water build up within the system. Less pumping, sampling, and disposal equals reduced operational cost and, most importantly, further environmental protection.

A Training Facility Utilization Report is generated for each firing event. Range Control expanded on this report to account for quantity and type of round fired on each lane. This data can be used to assess the overall wear and tear from rounds impacting the system's top cover, to include projected schedule for top cover replacement.

By observing range firing, it can be determined which type of ammunition or training will cause an increase in maintenance, specifically more patching of the top cover. The use of the 7.62mm (M240B) and/or firing the 5.56mm (M249 SAW) weapons, machine guns with heavy rates of fire that create beaten zones, and .40 cal hollow points were observed to cause increased wear.

Construction of STAPP™ and any bullet containment system should follow pre-established construction plans. The construction plans should include all pertinent Quality Control/Quality Assurance (QA/QC) steps necessary to ensure an acceptable end product. This is considered a lesson learned based on some of the maintenance required on the Tango Range STAPP™ system. It is speculated that top cover maintenance during the pilot program would have been less if more rigid QA/QC procedures were followed on the STAPP™ system installations.

7.3 ENVIRONMENTAL MONITORING

Based on soil sampling data from the range floor that has shown no apparent trend for lead deposition as a result of the bullet propellant, and the fact that the groundwater has not been impacted by lead from small arms ranges, soil sampling at Juliet, Kilo, and Tango Ranges is now performed at each range on alternating years.

Results from sampling groundwater wells on Tango Range indicate that there are generally no concentrations of lead, copper, or antimony above the action levels in groundwater. The one exception was the 24.1 ppb result from a sample collected from MW467S in 2015. Low water levels within the well necessitated the use of a bailer to retrieve a sample from this well. In accordance with the OMMP the well was resampled and the results were 4.1 ppb for lead which is below the action level for lead in groundwater as set forth by the OMMP. Upon resampling the well still had low water levels but the samplers were able to collect a single sample. Based on this experience groundwater samples should only be taken if appropriate water levels are present within the well and well screens.

Use of legacy soils in constructing the ranges can be problematic when it comes to soil contaminants such as metals. It is thought that the likely source of elevated antimony detections in pore water were from the use of legacy soils on the range. Maectite™ (phosphate) was used to immobilize lead in legacy soils during a 1998 berm treatment process for stabilizing lead in soil. Research has shown that phosphate can cause antimony to become more mobile in soil.

The soils of Camp Edwards do not need to have the pH adjusted as the native soil's pH is appropriate to avoid metals mobility at the small arms ranges.

Tension lysimeters are not appropriate for monitoring the soil porewater on small arms ranges. Materials within the tension lysimeters such as the ceramic cup and metal components can adsorb or release metals. As stated earlier in the report, these materials could cause false positive and negative readings in metals analysis.

Pan Lysimeters are now in use for soil porewater monitoring on STAPP™ Ranges. High Density Polyethylene (HDPE) is now used in lysimeters intended to sample soil porewater for metals as HDPE does not have the property of adsorbing metals.

With regards to lysimeters the EMCs SAC advised that a better methodology for tracking metals through soil as an early warning system for protecting groundwater would be to conduct spilt core soil sampling. This sampling will be implemented if it is approved. This was advised based on the fact that water can have preferential pathways, lysimeters only provide a point sample, and the residence time of water within the lysimeter where sediment and the lysimeter materials themselves can have affect the analysis of porewater.

If changes in training are approved and implemented at the small arms ranges, monitoring specified by the OMMP should be reviewed to ensure that it is appropriate for monitoring the change in training. As an example, when transition firing (where shooters advance forward of the 25m firing line) was approved the soil sampling specified by the current OMMP was changed to include a larger area of potential impact.

8.0 SUMMARY AND CONCLUSIONS

The Pilot Period for Tango Range began in August 2007 and in August 2008 for Juliet and Kilo Ranges. The objective of the Pilot Period was to assess the Tango, Juliet, and Kilo OMMP and the effectiveness of the STAPP™ system installed on these ranges. The Pilot Period most importantly gave the regulatory agencies a chance to review the effectiveness of range management and the MANG's ability to meet its commitment in operating small arms ranges at Camp Edwards in an environmentally sound fashion, i.e. no impacts to groundwater.

Approximately 16,968 individuals were trained over 425 total days of use on the STAPP™ ranges, using lead ammunition during the Pilot Period for Tango, Juliet, and Kilo Ranges. All firing events were monitored with inspections before, during and after training events as per the OMMP. Mass Balance and overshot analysis shows that approximately 94-99% of the bullets fired during training events were captured by the STAPP™ system and effectively isolated from the environment.

More maintenance was required on the STAPP™ system than was anticipated, particularly on the top cover and to remove water collected in the internal reservoir. However, the STAPP™ system is considered an effective system design to capture most of the bullets fired and isolate them from the environment.

The Conceptual Site Model with contaminant potential exposure pathways for the STAPP™ ranges was detailed in the OMMP. For lead, relevant literature including the CRREL Lead Report indicate that lead mobilization at small arms ranges occurs mainly by wind and surface water erosion and to a lesser extent through dissolution and leaching through soil. Lead is less mobile in soil at a neutral pH. Best Management Practices (BMPs) were implemented at Tango, Juliet and Kilo Ranges to minimize any potential environmental impact. Bullets captured within the STAPP™ system are effectively isolated from the wind and are not in contact with surface waters of the range. Based on the Conceptual Site Model, this removes the most likely migration pathways for lead and other metals. Based on annual range sampling of the firing line and range floor there has been no evident trend of lead deposition from propellants within the bullet primer.

Antimony has become a metal to monitor as OMMP action levels have been exceeded for porewater on Tango, Juliet, and Kilo Ranges. Elevated detections of antimony at concentrations exceeding the Action Level in several of the lysimeters have now been confirmed in several consecutive sampling rounds. It was thought that pH might be a contributing factor to the increased level of antimony in porewater. Liming of the ranges was put on hold in 2013 to determine if adjusting the pH could be a contributing factor to the increased levels of antimony in porewater. It appears that this is not the case based on porewater sampling results--levels have continued to rise. Another possibility causing an increase in antimony in porewater is that the lysimeters have sediments within the collection bucket where porewater can remain in contact with these sediments for an extended timeframe. Sediment contact time could be responsible for elevated antimony levels in pore water. It should be noted that the EMC's SAC has on multiple occasion suggested that this residence time of porewater in contact with sediments within the lysimeters can be problematic affecting sampling result. For this reason, the MANG will be analyzing both filtered and unfiltered pore water samples. Efforts will again be made to determine if there is sediment present within the lysimeters. If so, they will be purged of sediment. Another potential cause of elevated antimony in porewater can be phosphates, which were added to the range soils during the berm maintenance project of 1998. A phosphate-based amendment was added to range soils to decrease the mobility of lead. Unfortunately, phosphates can mobilize antimony. With time, phosphate levels will diminish, and so monitoring of antimony levels will continue along with close coordination with the regulatory community in regards to antimony in porewater. The two potential causes of elevated antimony levels, phosphate and sediment within the lysimeters, are not mutually exclusive and both could be contributing to this issue. An additional concern is that the lysimeters on both Juliet and Kilo Ranges are located within the drainage system of the ranges where storm water is collected from most of the range footprint. Therefore antimony may be concentrating within the lysimeter located within the system.

Careful monitoring of porewater should continue and continued consultation with experts in the field of metals mobility will be undertaken. Porewater sampling maybe replaced with split core soil sampling, as advised by the SAC, to more accurately track metals through soil. When the specifics for this type of sampling is determined and when approved, the MANG will implement this new protocol during the next sampling cycle.

The OMMP included broad monitoring to assess potential environmental impacts. Methods used for environmental monitoring included soil sampling for COCs, monitoring soil pH, sampling soil pore water via lysimeters, and sampling groundwater immediately down-gradient of the range. The results of the environmental monitoring during the Pilot Period shows that COCs are not migrating from the range but do need close scrutiny to assure no environmental impacts are imminent or occurring.

The BMPs and robust environmental monitoring implemented at the STAPP™ Ranges demonstrates the MANG's commitment to provide small arms range training at Camp Edwards all while being protective of natural resources, especially groundwater. The MANG has reviewed and evaluated all data generated during the Pilot Period. The MANG has considered conclusions in the CRREL Lead Report, ongoing studies on fate and transport of antimony and propellant related small arms range compounds and IAGWSP reports that investigated small arms ranges at Camp Edwards.

The MANG believes that EPA's issues as identified in AO2 and the approval letters for the STAPP™ ranges (Juliet, Kilo, and Tango Ranges) have and will be continually addressed to be protective of the Camp Edwards Training Area/Upper Cape Water Supply Reserve. Specific tasks completed and issues addressed include:

- Lead and lead contaminated soil was removed from impact berms as a mitigation measure and further removal has been conducted as identified in the Decision Document, Small Arms Range Operable Unit, and (September 2015).
- Research was conducted into the use of projectile capturing material and nontoxic ammunition. The MANG has three ranges using a STAPP™ Bullet Catcher System and two ranges that are utilizing nontoxic ammunition, i.e. copper projectiles.
- The MANG now uses lead bullets on ranges that have a system in place to capture the projectiles or the range is managed through an OMMP.
- The Department of the Army and the MANG are transitioning to copper rounds, namely the Enhanced Performance Round currently used on India and Sierra ranges at Camp Edwards.
- OMMPs are created for all approved ranges and devices. These plans have been developed in partnership with EPA, MassDEP, and the EMC. The goal of these plans is to avoid any releases or damage to the environment that may cause harm to the Camp Edwards Training Area/Upper Cape Water Supply Reserve's groundwater resources. These plans provide for the monitoring of environmental media that includes soil, porewater, and groundwater. Monitoring data show that current small arms range training activities at the STAPP™ ranges, when properly

operated and maintained, can be conducted without causing unacceptable contamination levels in the groundwater.

- Through the last nine years of the Pilot Period, the MANG successfully operated, managed, and funded the active ranges at Camp Edwards. Although there have been unanticipated problems with the STAPP™ systems, the MANG has been diligent in investigating, researching, and implementing solutions to problems as they are discovered.

Working closely with EPA, MassDEP, the EMC, stakeholders and the public over the past nine years, the MANG has successfully implemented training with lead ammunition.

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APPENDIX A

Juliet, Kilo, and Tango Range Operation, Maintenance, and Monitoring Plan
Revised 15 July 2015.

BEST MANAGEMENT PRACTICES

AND

OPERATIONS, MAINTENANCE, AND MONITORING PLAN

FOR

JULIET, KILO, AND TANGO RANGES

AT

CAMP EDWARDS, MASSACHUSETTS

Prepared by:

Massachusetts National Guard
Environmental & Readiness Center
Bldg. 1204 West Inner Road
Camp Edwards, MA 02542

8 April 2014
(Revised 15 July 2015)

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ACRONYMS & ABBREVIATIONS

AEC	Army Environmental Command
AO	Administrative Order
ASP	Ammunition Supply Point
BMP	Best Management Practice
cm	Centimeter
CSM	Conceptual Site Model
DoD	Department of Defense
DODIC	Department of Defense Identification Code
DPT	Director of Plans and Training
EMC	Environmental Management Commission
EPA	US Environmental Protection Agency
E&RC	Environmental and Readiness Center
FCC	Facility Category Code
FE	Facilities Engineering
HEPA	High-Efficiency Particulate Air
HMWMP	Hazardous Material and Waste Management Plan
IAGWSP	Impact Area Groundwater Study Program
Kg	Kilogram
L	Liter
m	Meter
MAARNG	Massachusetts Army National Guard
MassDEP	Massachusetts Department of Environmental Protection
MCL	Maximum Contaminant Level
MMCL	Massachusetts Maximum Contaminant Level
mg	Milligram
MIS	multi-increment sample
MMR	Massachusetts Military Reservation
NGB	National Guard Bureau
OMMP	Operations, Maintenance and Monitoring Plan
P2	Pollution Prevention
RFMSS	Range Facility Management Support System
RSO	Range Safety Officer
SACON	Shock Absorbing Concrete
SAR	Small Arms Range
TCLP	Toxicity Characteristic Leaching Procedure
ug	Microgram
USAEC	US Army Environmental Command
XRF	X-ray Fluorescent

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1.0 INTRODUCTION

Camp Edwards is an important training center for National Guard, Reserve Components, US Coast Guard, and law enforcement agencies throughout the northeastern United States. Located on Cape Cod, Camp Edwards contains threatened and endangered wildlife species, prime wildlife habitat, archeological sites, and culturally sensitive areas. Moreover, the Camp sits on top of the Sagamore lens, a sole-source drinking water aquifer for Cape Cod. The northern 15,000 acres of Camp Edwards, the Upper Cape Water Supply Reserve/Training Area, are located within the recharge area of the aquifer.

Camp Edwards is committed to excellence in environmental protection, training, readiness, and management of training sites. Training facilities available at Camp Edwards include small arms ranges (SARs), training areas, a tactical training base, counter-IED lanes, land navigation courses, battle positions, observation posts, and maneuver roads and trails. These facilities support a variety of training activities that include small arms marksmanship. In particular, the SARs support training and qualification in basic infantry skills with small arms weapons systems, including pistols, rifles, machine guns, and shotguns. The Massachusetts Army National Guard (MAARNG) will seek to constantly improve upon training practices that protect the future of the surrounding ecosystem and the aquifer, and maintain a viable ready force.

1.1 Purpose

The purpose of this Best Management Practices (BMP) and Operations, Maintenance, and Monitoring Plan (OMMP) is to identify the operations and management practices that MAARNG will implement at the ranges. This plan identifies BMPs that allow the employment of small arms at J, K, and T ranges (**Figure 1-1**) in a manner that:

- Meets current and future training requirements, and
- Employs maximum feasible use of pollution prevention (P2) strategies to protect the Upper Cape Water Supply Reserve which is managed as a Massachusetts Department of Environmental Protection (MassDEP) Zone II for public water supplies.

This plan supports the *Camp Edwards Pollution Prevention Overview (Small Arms Range Supplement)* (SAR P2 Overview) (MAARNG 2007) and is designed to be approved by the EPA and the Environmental Management Commission (EMC) in accordance with US EPA Region 1 Administrative Order 2 (AO2) and the Environmental Performance Standards (EPSs), respectively.

Lead-free copper bullets such as DoD Identification Code (DODIC) M855A1 will not be used on ranges with STAPP™ systems without verifying that the projectiles will not puncture the liner.

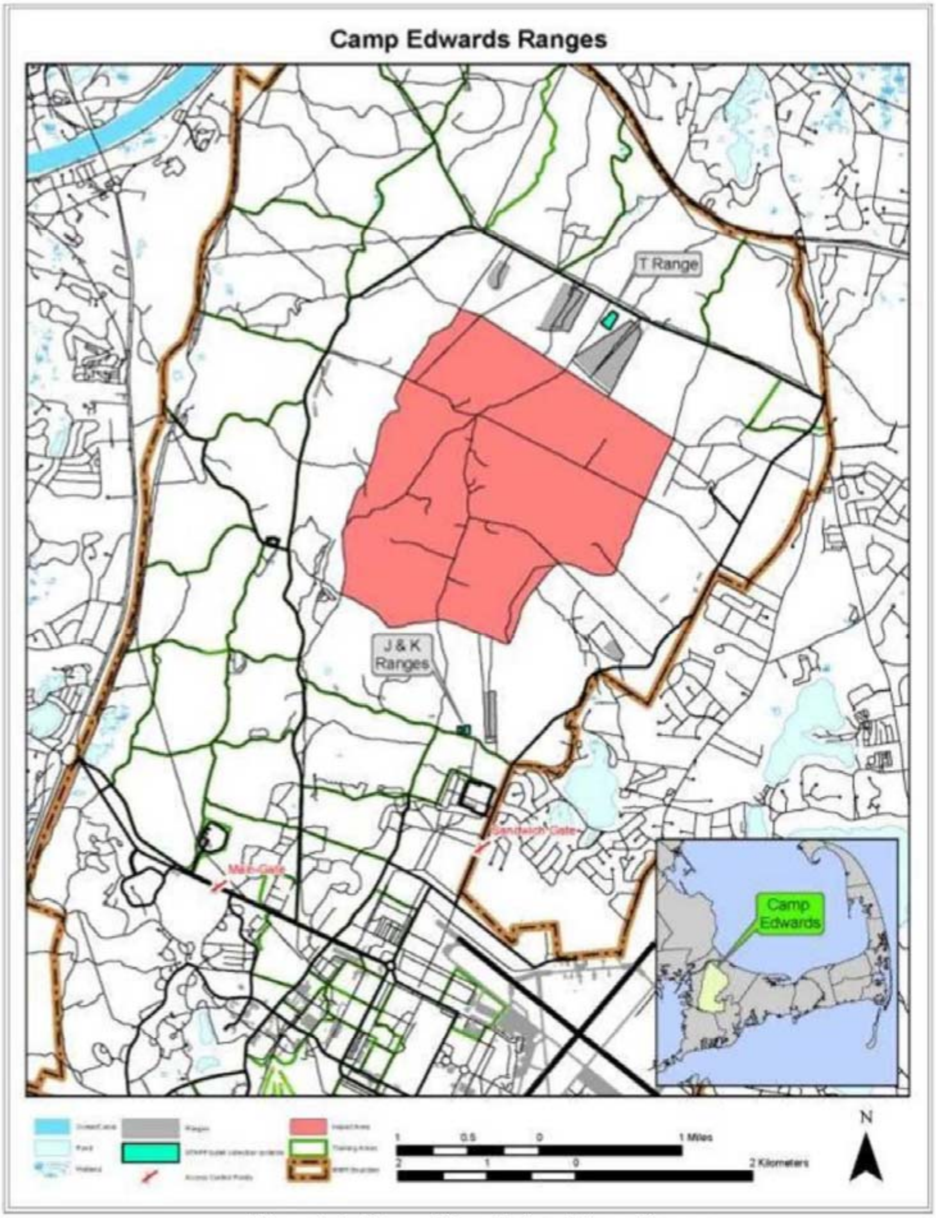

Figure 1-1. Camp Edwards Small Arms Ranges

1.2 Scope

This OMMP is limited to the operation and use of J, K, and T ranges. It supports the use of J, K, and T ranges as 25-m Rifle/Machine Gun Zero Ranges (Facility Category Code [FCC] 17801) to meet current and anticipated requirements for small arms training exercises at Camp Edwards for both military and civilian users.

Although this plan identifies specific BMPs for the management of metals to sustain operations at J, K, and T ranges, the scope of the BMPs addressed is not limited to typical environmental management options. It also includes BMPs for safe and efficient administration, use, management, and maintenance. The BMPs recommended in this plan are based on range-specific conditions and are not intended to apply to other SARs at Camp Edwards or on other Army or Department of Defense (DoD) installations or ranges.

Specific Requirement: As with any structural system and or equipment the STAPP System will have an operational life-cycle. At the end of the STAPP systems life-cycle the MAARNG will develop a Dismantling Plan that will address the process for disassembling and disposal of the STAPP System. This plan will be provided to the USEPA and the EMC prior to the initiation of any dismantling and disposal actions of the STAPP System on Juliet, Kilo, and Tango Ranges.

This OMMP identifies potential pathways for migration of, and potential exposure to, contaminants from J, K, and T ranges. Environmental management and P2 BMPs are analyzed and selected based on their ability to disrupt the pathways to potential receptors.

2.0 RANGE DESCRIPTIONS

J, K, and T ranges will be used as standard 25-m Rifle/Machine Gun Zero Ranges primarily in support of training with M16 and M4 rifles, M249, M240B, and M60 machine guns. These ranges can also be used for pistol marksmanship and as an alternate qualification course for M16.

2.1 Juliet Range

Juliet Range is located north of Pocasset-Forestdale Road and west of Greenway Road. It was established in the late 1980s at the site of the former U.S. Air Force A pistol range. Records indicate it has been used as a pistol and rifle range since the name changed to Juliet Range.

Seventeen firing points exist along the firing line. Paper silhouette targets on wooden frames are located 25m from the firing line and a berm backstop is located behind the targets. Lead or lead-antimony bullet ammunition including 5.56mm, .38 caliber, 9mm, .40 caliber, .45 caliber, and 12 gauge was fired on Juliet Range through 1997. The backstop berm was treated for lead during the 1998 Berm Maintenance Program (NGB 1998). The program removed spent projectiles from the soil, and then treated the soil with Maectite™ to immobilize remaining lead.

Beginning in 1999, the MAARNG and civilian personnel began using alternate ammunition composed of tungsten powder held together with nylon. Tungsten-nylon rounds were fired on Juliet Range until December 2005 when the MAARNG ceased all use of tungsten-containing bullets. In 2006, the soil on the front face of the berm was removed to reduce tungsten concentrations on the range. The soil was transported and disposed off site.

The Army Environmental Command's (AEC's) Impact Area Groundwater Study Program (IAGWSP) completed an investigation of soil and groundwater conditions on Juliet Range in 2008. No significant groundwater contamination was found. The investigation determined that the soils pose no long- or short-term threat to groundwater resources.

The STAPP™ system was constructed on the face of the same berm in 2008 to capture and contain bullets fired on the range. The STAPP™ system isolates expended bullets from the environment and prevents movement of metals into soil. Protective timber "toe berm boxes" behind the target frames provide undershot protection for the base of the STAPP™. Active use of the range commenced under a pilot period in 2009. **Figure 2-1** shows the key features of Juliet Range.

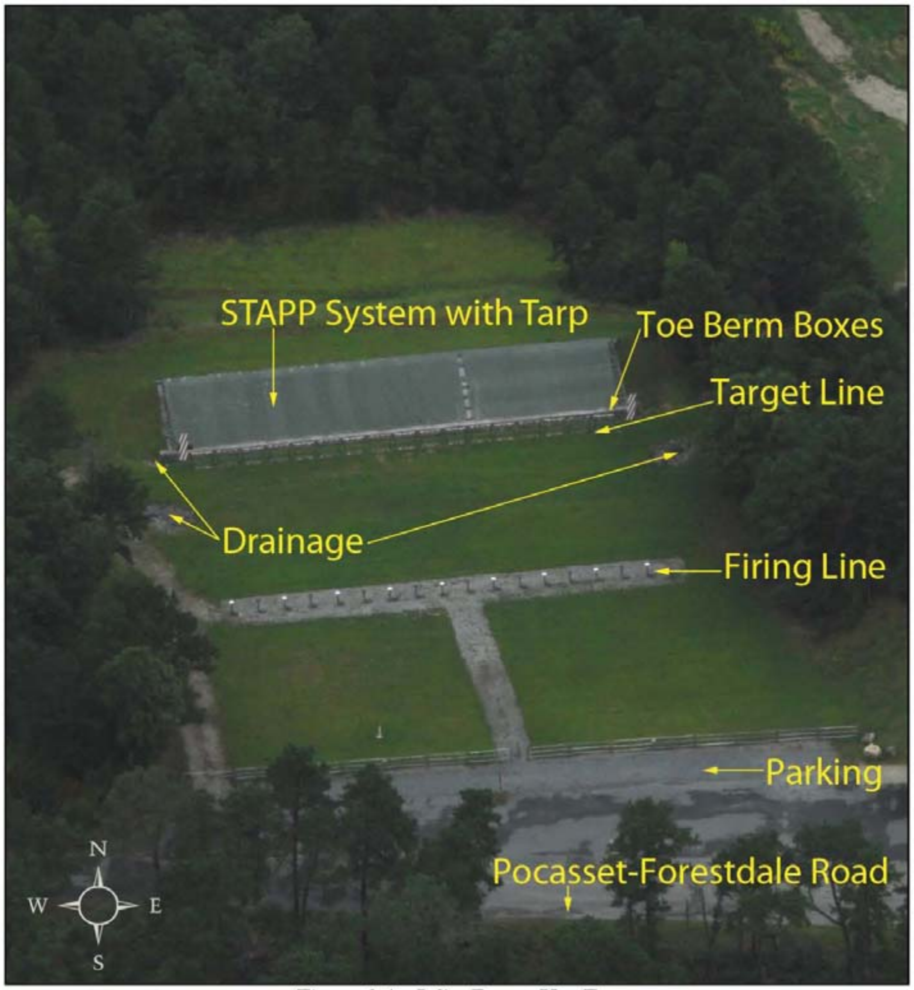

Figure 2-1. Juliet Range Key Features

2.2 Kilo Range

Kilo Range is located north of Pocasset-Forestdale Road and west of Greenway Road adjacent to the east side of Juliet Range. Juliet and Kilo ranges are separated by a soil berm covered with trees. Kilo Range was established in the late 1980s at the site of the former U.S. Air Force B pistol range. Records indicate it has been used as a pistol and rifle range since the name changed to Kilo Range.

Twenty-nine firing points exist along the firing line. Target frames are 25 meters north of the firing line. Before construction of the STAPP™ system on this range, an earthen backstop berm

142 feet beyond the targets stopped bullets. Lead-bullet or lead-antimony bullet ammunition including 5.56mm, .38 caliber, 9mm, .40 caliber, .45 caliber, and 12 gauge was fired on Kilo Range through 1997.

The backstop berm was treated for lead during the 1998 Berm Maintenance Program. The program involved removing spent projectiles from the soil, then treating soil with Maectite™ to immobilize remaining lead.

Beginning in 1999, the MAARNG and civilian personnel began using alternate ammunition composed of tungsten powder held together with nylon. Tungsten-nylon rounds were fired on Kilo Range until December 2005 when the MAARNG ceased all use of tungsten-containing bullets. In 2006, the soil on the front face of the berm was removed to reduce tungsten concentrations on the range. The soil was transported and disposed off site.

The IAGWSP completed an investigation of soil and groundwater conditions on Kilo Range in 2008. No significant groundwater contamination was found. The investigation determined that the soils at the range pose no long-term or short-term threat to groundwater resources.

A new berm was constructed for the STAPP™ system closer to the target line and the STAPP™ system was installed in 2008. The soil berm on Kilo Range is directly aligned with the existing berm on Juliet Range allowing the ranges to operate simultaneously when needed. The old berm remains in place behind the new berm. Protective timber "toe berm boxes" behind the target frames provide undershot protection for the STAPP™. Active use of the range commenced under a pilot period in 2009. **Figure 2-2** shows the key features of Kilo Range.

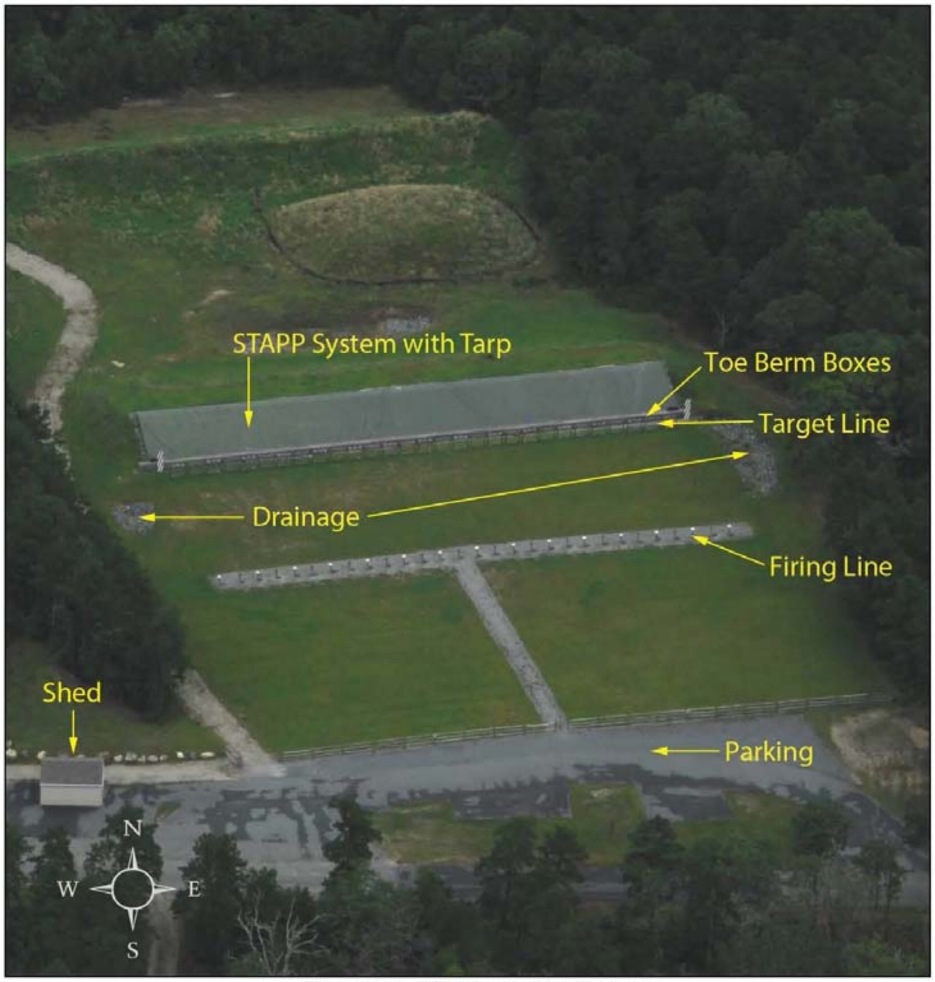

Figure 2-2. Kilo Range Key Features

2.3 Tango Range

Tango Range is located in the northern portion of Camp Edwards and is accessed via Gibbs Road. Tango Range has historically supported multiple training activities. In the late 1980s, Tango Range was an assault course where blank ammunition was primarily used. In 1990-1991, the MAARNG began using Tango Range to familiarize soldiers with firing the .50 caliber M2 machine gun using plastic bullets. In the early 1990s the MAARNG used Tango Range to support pistol marksmanship training with 9mm lead-antimony-bullet ammunition being fired until 1997. Subsequently, military and civilian law enforcement personnel fired frangible (copper and/or tungsten powder composite) bullets in .38 caliber, 9mm, and .40 caliber on Tango Range. For a short period 12 gauge shotgun ammunition was also fired on Tango Range.

Beginning in 1999, the MAARNG and civilian personnel began using alternate ammunition composed of tungsten powder held together with nylon. Tungsten-nylon rounds were fired on Tango Range until December 2005 when the MAARNG ceased all use of tungsten-containing bullets. There was no backstop berm on Tango Range.

Until 2007, Tango Range had two distinct firing lines. The first firing line consisted of six soil mounds used as machine gun firing positions. In the middle of the six mounds, next to the range tower, was a hardened trail for mounted machine gun firing from a parked tactical vehicle. The machine gun firing line has been knocked down and the soil was used to raise the 25m firing line approximately 18 inches to improve the angle of fire into the new STAPP™ system. The current line is 44m long with 15 firing positions.

The IAGWSP completed an investigation of soil and groundwater conditions on Tango Range in 2007. No significant groundwater contamination was found. The investigation determined that the soils pose no long-term or short-term threat to groundwater resources.

The STAPP™ system was installed on a newly constructed berm in 2007. Protective timber "toe berm boxes" were also installed behind the target frames to protect the base of STAPP™ system from undershot. **Figure 2-3** shows the key features of Tango Range.

Active use of the range as a 25m zero range commenced under a pilot period in 2007.

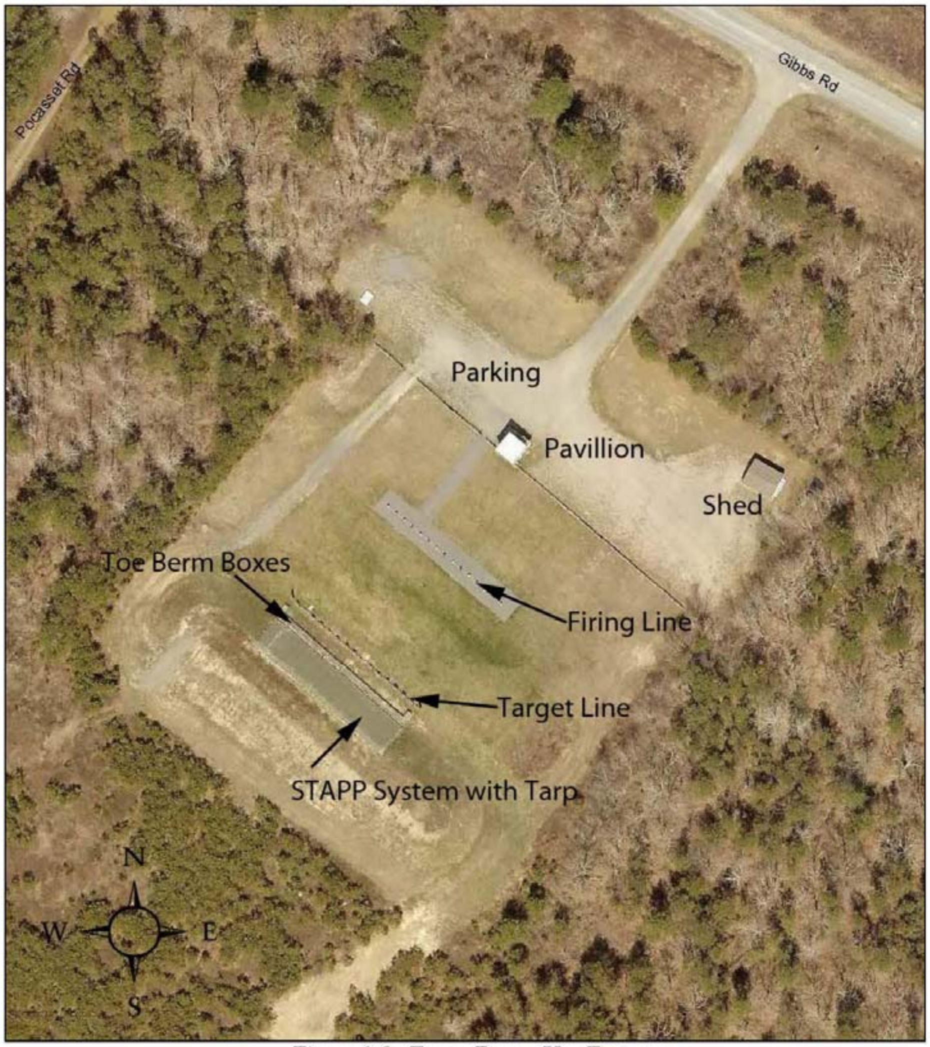

Figure 2-3. Tango Range Key Features

3.0 ENVIRONMENTAL DRIVERS

For MAARNG to continue effective small arms training, two significant legal drivers define the path forward. They are EPA Region 1 AO2 and M.G.L. Chapter 47 of the Acts of 2002, and associated Environmental Performance Standards dated 11 July 2007. The development of range-specific OMMPs to prevent the migration of pollution to the water supply and sensitive natural resources and the maximum feasible use of pollution prevention technologies fulfills the requirements of both of the drivers.

EPA's AO2 was issued in April 1997. AO2 required that Camp Edwards cease certain training activities (e.g., firing lead small arms ammunition, artillery fire, and mortar fire) pending environmental investigations. These activities are still prohibited.

Appendix A, Section II.E of AO2 states the following conditions and requirements for the resumption of prohibited training activities. "If…EPA approves resumption of Respondents' activities at the Training Range and Impact Area, Respondents shall ensure maximum feasible use at such time of pollution prevention technologies in any training activities. Specific measures to be evaluated by Respondents include the following:

- Use of non-toxic lead-free combat ammunition;
- Use of bullet traps at all small arms ranges;
- Use of munitions-capturing material, such as 'SACON';
- Use of non-exploding artillery and mortar rounds; and
- Development of guidance for the operation and maintenance of the ranges consistent with the pollution prevention strategies."

As required by AO2, Range Control will coordinate training activities with environmental cleanup programs working within the training area of Camp Edwards so that unnecessary loss of clean up or training time is avoided.

Chapter 47 of the Acts of 2002 codified the EPSs in a Memorandum of Agreement, ensuring permanent protection of the drinking water supply and wildlife habitats in the Reserve/Training Area while allowing compatible military training. It created the EMC to oversee compliance with, enforcement of, and modifications to the EPSs and environmental laws and regulations within the Reserve/Training Area.

Based on the conceptual site model (CSM), evaluations of SAR P2 BMPs conducted in the SAR P2 Overview, and the current assessment of training and management at J, K, and T ranges, the STAPP™ system provides positive BMPs for small arms training with lead ammunition. As such, the MAARNG will continue to satisfy the requirement of AO2 and the EPSs to employ "maximum feasible use" of P2 technologies by:

- Implementing a system of range upgrades and BMPs that will either sever potential migration and exposure pathways or monitor environmental conditions to confirm that pathways remain incomplete.
- Implementing a "contain, maintain, and monitor" approach to SAR BMPs that will include redundant methods to prevent pollution (e.g., bullet containment, pH monitoring

and when needed, pH management, erosion control) and methods to assess the effectiveness (e.g., inspections, sampling) of each system in each environmental media (e.g., soil, groundwater).

This approach will include:

- Managing metals at their source through containment in the STAPP™ system and periodic removal and recycling.
- Monitoring potential migration pathways, such as surface soil, soil-pore water, and groundwater to evaluate whether contaminants are being transported in environmental media.
- Implementing a number of other monitoring and maintenance BMPs to sustain the conditions that limit metals mobility (e.g., monitoring the condition of the bullet containment system, storm water management, maintaining healthy vegetation on range areas to prevent soil erosion, maintaining windbreaks to limit windborne metals transport, and monitoring and when necessary, maintaining soil pH to minimize corrosion, dissolution, and mobility of metals in the environment.

The BMPs selected and described in this OMMP will support the use of small arms on J, K, and T ranges in a manner that meets training requirements while protecting human health and the environment. As environmental conditions or the understanding of conditions change, it may become necessary to add or modify management actions to protect human health and the environment. All such modifications to training activities or management actions will be fully coordinated with the EMC, EPA, and MassDEP.

4.0 TRAINING DESCRIPTION

The MAARNG will conduct marksmanship training on Juliet, Kilo, and Tango ranges using standard lead antimony bullet ammunition. The use of tracer ammunition on J, K, and T Ranges **is not** currently authorized. Tracer ammunition cannot be used until such time that the requirements of the regulatory approvals, 2007 and 2009, for use of tracers on J, K, and T Ranges are completed. The requirement is to conduct a night test fire to determine if there are problems associated with ricochets off of target frames or any other target area surface. Familiarization, zeroing, and, marksmanship training may include the use of the M16 and M4 rifles and the M249 machine gun with 5.56mm ammunition and the M110 sniper rifle and the M240 and M60 machine guns using 7.62mm ammunition. All pistol calibers below .50 caliber can be used on J, K, and T Ranges. Pistol ammunition includes .22, .357, .38 (M41), .40, 9mm (M882), .45 (M1911), and .44 calibers. The most frequently utilized pistol caliber on J, K, and T ranges, by both law enforcement and military, is the 9mm (M9).

The list of currently authorized military ammunition DODICs for J, K & T Ranges are as follows:

A058, CTG, 5.56MM Ball M855
A059, CTG, 5.56MM Ball M855 Clipped
A062, CTG, 5.56MM Ball M855 Linked
A063, CTG, 5.56MM Tracer M856 Single Round
A064, CTG, 5.56MM 4 Ball M855/ 1 Tracer M856 (Temporary Restriction, 5.56mm Tracer)
A066, CTG, 5.56MM BALL M193
A068, CTG, 5.56MM TRACER M196
A071, CTG, 5.56MM Ball M195 Clipped
AA11, CTG, 7.62MM Ball Match Grade for the M110
A124, CTG, 7.62MM TRACER M62/T
A128, CTG, 7.62MM Ball M80 Linked
A131, CTG, 7.62MM 4 Ball M80/ 1 Tracer M62
A363, CTG, 9MM Ball XM/M882
AA33, CTG, 5.56MM Ball M855 (Commercial Pack)
AA49, CTG, 9MM Ball M882

Current ammunition used by ISA and Law Enforcement:

AC01, CTG, 9MM American Eagle Full Metal Jacket (commercial)
AC02, 9MM Blazer Total Metal Jacket (commercial)

Armor piercing rounds, incendiary rounds, frangible rounds, plastic rounds, tungsten-based rounds, and ammunition for weapons systems not listed are PROHIBITED for use on J, K, and T Ranges. These rounds WILL NOT be used on STAPP™ Ranges until the system is validated for use with these rounds and the decision to use them is coordinated with and approved by Range Control, the ERC, and the EMC.
Lead-free copper bullets, DODIC M855A1, WILL NOT be used on ranges with STAPP™ systems without review and concurrence by Camp Edwards Range Control, Environmental and

Readiness Center, and the EMC. Other governmental agencies such as law enforcement, Federal Bureau of Investigation, and Drug Enforcement Administration may be able to acquire and use solid copper ammunition to satisfy training requirements. This alternative ammunition will be contained, managed, and monitored in the same manner as the standard issue service ammunition at such time that it is approved for use on J, K and T Ranges.

4.1 Use Procedures and Restrictions

Camp Edwards Regulation TAGMA PAM 350-2 outlines extensive rules and procedures for the ranges and training lands on Camp Edwards. It notes that, "Users are to minimize environmental disturbance to protect the ecosystem as well as preserve the long-term value of our training site." Applicable subsections of this manual that apply to J, K, and T ranges are:

- Section 2-3, Safety and Environmental Briefing
- Section 2-5, Ammunition, Demolition, and Pyrotechnics Restrictions
- Chapter 3, Environmental Considerations
- General Training and Environmental Protection Approvals and Conditions

Range Control personnel are well-versed with this regulation and educate Range Safety Officers (RSOs) during the scheduling and issuance of ranges to using units. Camp Edwards personnel oversee and assist the training conducted on J, K, and T ranges and evaluate whether training is conducted in accordance with operational, safety, and environmental requirements.

Before occupying J, K, or T Range, the unit must designate an RSO who will receive a safety briefing. The briefing informs units of the installation's restricted areas, misfire and malfunction procedures, communication procedures, and environmental considerations. Procedures directly related to environmental protection include:

- Cleaning/lubricating/preservative compound (CLP) and other weapons maintenance, cleaners, and lubricants will be conducted in a manner that minimizes the potential for spills and a release to the environment. Personnel will sparingly use these products when maintaining their weapons. When CLP containers are not in use, dependent upon their size, they will be kept on the soldier's person; or, when not in use these containers will have their lids on and should be placed in an appropriate secondary container, like a drip pan or 5 gallon bucket. An appropriate container is one that will contain the product when the original container is compromised and or if spilled. If cleaning materials are used on the range; rags, patches, and other cleaning materials, they will be thrown away into a separate plastic trash bag inside of an issued 5 gallon bucket labeled Waste Weapons cleaning material. This bucket will then be inspected by Range Control and disposed of at the Satellite Accumulation Point by a trained Range Control employee.
- Units will use portable latrines.
- Conservation of ammunition will be enforced; "burning off" ammunition is not authorized. All rounds being fired down range must be in conjunction with a firing table.
- Soldiers will expend all ammunition from the designated firing positions along the firing line (between the maximum distance of 25m and minimum distance 3 yards) within the firing lanes downrange to the targets. No weapons will be discharged:

  - Without permission from the Range Safety Officer; or,
  - Forward of the firing line or across firing lanes; or,
  - At an angle of fire inconsistent with bullet trajectory through the target holder and into bullet containment systems.
- All shots, and hence considerations for target placement, must be aimed below the red line painted across the upper portion of the STAPP™ bullet collection system.
- Units must get approval from Range Control prior to employment of tracer and hollow point ammunition on J, K, and T ranges.
  - The delinking of tracer rounds is not authorized (MAARNG 2006).
  - Inspect the top cover immediately following training events where hollow points are employed and initiate repairs in accordance with **Section 10.1**.
- The Range Control Officer (or authorized designee) will conduct periodic inspections of J, K, and T range while they are operational to ensure that all users are following all applicable regulations, BMPs, SOPs, and safety requirements.
- Ensure that training is conducted in accordance with applicable procedures.
- After training with Automatic Weapons (e.g. 7.62mm, M4) the Range Control Officer (or authorized designee) will inspect the surface of STAPP™ to assess whether irregularities have formed at the surface due to rearrangement of rubber filler material from automatic firing. If it is determined that there has been a seam failure or significant reduction in rubber filler (15 inches or less) the appropriate repairs will be initiated in accordance with **Section 10** of this plan.

4.2 Training Capacity

MAARNG will track and report the actual amount of ammunition fired on J, K, and T ranges annually. The following information will be collected each time J, K, and T ranges are in use: total number of personnel trained, the weapon systems used, the type of ammunition, and the number of rounds expended (See Appendix A, Training Facility Utilization Report).

This information will be included in the annual State of the Reservation Report and the Range Utilization Report (**Section 12**).

5.0 ROLES AND RESPONSIBILITIES

To implement this OMMP, Camp Edwards will involve a team of experts to manage training operations, facility maintenance, and environmental protection functions.

5.1 Training Site Commander

The Training Site Commander is responsible for the overall operation of Camp Edwards to include the immediate supervision, control, coordination, and safety of all Camp Edwards facilities and promotion of mission compatible and environmentally sustainable uses of Camp Edwards resources.

5.2 Director of Plans and Training

The Director of Plans and Training (DPT) is the primary advisor to the Training Site Commander on all matters concerning the safe, efficient utilization of Camp Edwards training facilities. Within the overall responsibility for Range Control operations, the DPT will:

- Identify and program for range modernization, operations, and maintenance requirements based on training load and doctrine; and
- Include requirements within the SAR P2 Overview and OMMPs for planning and budgeting actions as appropriate for sustainable ranges.
- Provide review, comments, and approval of the SAR P2 Overview and OMMPs;

5.3 Range Control Officer

The Range Control Officer is the primary representative of the Training Site Commander at Range Control and, as such, will:

- Coordinate range modernization requirements and oversee range modernization projects;
- Control access to ranges;
- Schedule and issue ranges to using units and clear/close out units upon completion of range use;
- Coordinate operation of ranges and oversee using units while training on Camp Edwards ranges;
- Enforce applicable guidance and regulations, range standard operating procedures, and safety requirements;
- Conduct periodic inspections of range conditions and identify requirements for repair and maintenance;
- Coordinate the repair of damage to range facilities (e.g., bullet containment systems);
- Collect Training Facility Utilization Reports from using units;
- Maintain range utilization, inspection, repair, and maintenance records;
- Coordinate necessary maintenance on SARs to include:
    - Periodic metals removal from STAPP™ systems;
    - Repair of damaged range facilities (e.g., bullet containment systems); and,

  - Repair of erosion damage to firing points, target areas, berm, and other range areas;
- Coordinate necessary maintenance on all training support facilities on ranges (e.g., bleachers, parking areas, buildings).

5.4 Environmental and Readiness Center

The Environmental and Readiness Center (E&RC) is the primary representative for the Training Site Commander for accomplishing sustainable environmental management requirements. To support the sustainment of small arms training at Camp Edwards in accordance with environmental agreements, orders, and regulatory and legal requirements, the E&RC will:

- Make adequate professional personnel resources available to the DPT and Range Control Officer to oversee or review implementation of P2 or pollution control BMPs;
- Coordinate with the Range Control Officer and FE to support the recovery, management, recycling, or disposal of metals from ranges in accordance with DoD guidance and federal and state solid waste regulations, as applicable;
- Conduct periodic reviews of range OMMPs;
- Coordinate with MAARNG Environmental personnel, both full-time and part-time, to conduct periodic inspections of J, K, and T ranges to ensure compliance with the BMPs;
- Coordinate required environmental sampling and monitoring on ranges; and
- Ensure coordination with the EMC, EPA, MassDEP, and other appropriate federal, state, and local environmental resource protection agencies to monitor concerns with SAR operations.

5.5 Ammunition Supply Point

Camp Edwards Ammunition Supply Point (ASP) is responsible for the care and storage of all munitions on the training base. The ASP is responsible for the issuing and turn in of all munitions and debris.

- Ensure that units firing on J, K, and T ranges only draw approved ammunition for J, K and T ranges.
- Coordination with Range Control on J, K, and T Range utilization by reviewing the weekly Range Bulletin.
- Copper rounds (such as the M855A1 Enhanced Performance Round) will not be issued to any units that are firing on J, K, or T ranges.

5.6 Sustainable Range Program

The purpose of the program is to ensure internal coordination and communication on all proposed training venues and to ensure compliance with the Camp Edwards small arms range Operation Maintenance and Monitoring plans. The Sustainable Range Program meets monthly.

The Sustainable Range Program includes:
- Camp Edwards Plans and Training Officer

- Range Control OIC
- Facility Engineering OIC
- Environmental & Readiness Center Representative
- Integrated Training Area Management Program Manager
- Additional staff as needed

The standing agenda items will include:

- Review of upcoming reporting requirements.
- Assessment of STAPP™ water management.
- Review and update of OMMP Plan and Standard Operating Procedures.
- Analyze upcoming and proposed training events.

The Sustainable Range Program Coordinator, Director of Plans and Training, will brief the Camp Edwards Commander, who in turn will present issues to the Chief of Staff, Joint Force Headquarters, Massachusetts National Guard, monthly. The Chief of Staff will then elevate any issue to The Adjutant General's Office as needed.

6.0 DETAILS AND SPECIFICATIONS OF BULLET CONTAINMENT SYSTEM

J, K, and T ranges employ several features that collectively prevent metals migration; they include the STAPP™ system, the vegetated back slope, and the vegetated range floor. The most significant feature is the STAPP™ system itself, which will contain the majority of the fired bullets. The STAPP™ system is a rubber multi-layer sandwich framed by synthetic lumber; the system consists of a bottom rubber membrane, a matrix of rubber granules, and a cover that permits bullets to pass through but minimizes precipitation getting inside the system. **Figure 6-1** shows a typical STAPP™ system installed on an earthen berm at a Camp Edwards SAR.

Figure 6-1. Juliet Range STAPP™ System

The impermeable liner (**Figure 6-2**) prevents bullets in the granular rubber from interacting with berm soil. Additionally, the liner will collect condensation or rain water that has passed through perforations in the cover and will direct it toward the water collection piping for removal and disposal in accordance with local, state and federal law.

Figure 6-2. STAPP™ System Bottom Liner

Figure 6-3. Water Port, Perforated Pipe, & Rubber Granules

To protect the base of the STAPP™ systems from undershot, a series of sand-filled timber framed toe berm boxes have been placed behind the target frames. The toe berm boxes are constructed with 6" x 6" pressure treated timbers and covered with a pressure treated plywood top. The tops of the toe berm boxes are treated with a weather sealant to shed rain water. The toe berm box placement is illustrated in **Figure 6-4**.

In addition to the toe berm boxes placed to protect the base of the STAPP™ system, the ground surface between the target line and the berm with STAPP™ is graded in such a fashion that the base of STAPP™ is below the target line. This grade/elevation difference will provide additional protection to the base of STAPP™ when bullets are fired from the 25-meter firing line. **Figure 6-4** provides an exaggerated view of the grade difference between the target line and STAPP™. This area will be appropriately graded to reduce erosion and manage surface water runoff. The ranges are graded and maintained to minimize the potential of any long-term standing water. See **Section 9.3** for further discussion on storm water management.

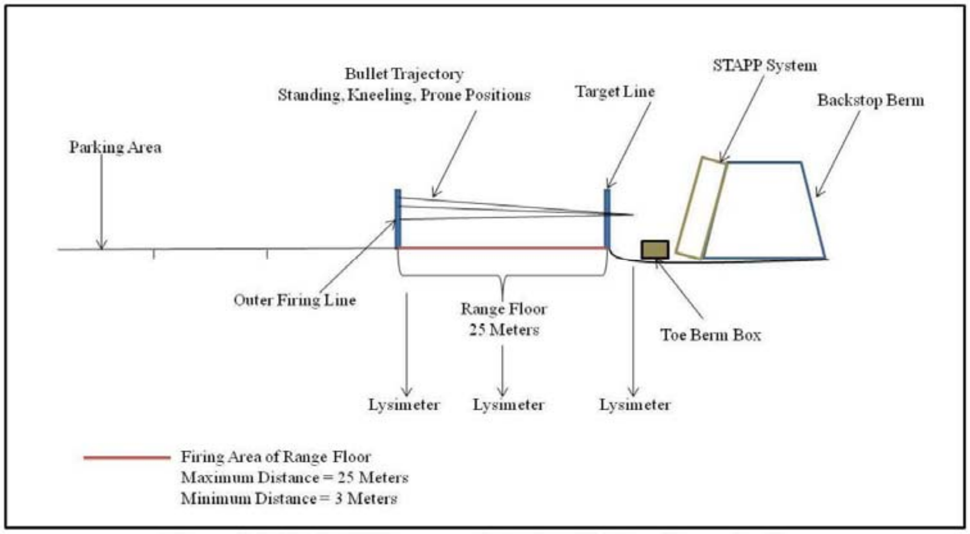

Figure 6-4. STAPP™ System and Typical 25 Meter Range Set Up

7.0 RANGE OPERATIONS

This section provides guidance for the operation of J, K, and T ranges that is consistent with, and complimentary to, the P2 strategies evaluated and selected in the SAR P2 Overview. The following guidance satisfies the criteria identified by MAARNG for the "maximum feasible use of P2." As such, guidance was developed to be implementable, protective of human health and the environment, and to be cost effective.

7.1 Range Access

J, K, and T ranges are secure sites; trespassers are prohibited and hunting activities are not authorized on these ranges.

7.2 Range Scheduling

The ranges may be used for weekend training, inactive duty training, or during the two-week-long annual training periods of MAARNG units. Deploying and Annual Training units have the first priority for scheduling training areas and ranges over Individual Duty Training and civilian requests. Per TAGMA PAM 350-2, Range Control schedules use of J, K, and T ranges based upon written input received from using units. Units forward a written request to "Commander Camp Edwards, ATTN: Range Control" or use the Range Facility Management Support System (RFMSS) Program stating the dates and facility desired. The written request must include the anticipated number of soldiers or other users occupying and using the range, the types of weapons to be used, the types of ammunition to be used (by DODIC), and estimated amounts of ammunition to be expended. A master schedule is available for viewing electronically via the RFMSS Program. To avoid conflicts, co-use of a previously scheduled area will be confirmed only after Camp Edwards Operations and Range Control receive a written consent from the originally scheduled unit.

7.3 Issuing and Clearing the Range

A unit representative will sign out J, K, or T Range from Range Control prior to occupation or use. Units must confirm the information provided at the time the range was scheduled (e.g., numbers of users, weapons, and ammunition). Each unit will receive a J, K, or T Range usage packet, which will include a Weekly Range Bulletin. This bulletin indicates training facilities scheduled, airspace requirements, local restrictions, and other information pertinent to units training at Camp Edwards. Commanders are responsible for distribution to subordinate units and appropriate personnel. Prior to occupation, or immediately thereafter, Range Control personnel, along with a unit representative, will inspect the range and report any deficiencies immediately to Range Control (**Section 4.1**).

Camp Edwards personnel will conduct safety and environmental awareness briefings to designated Officers in Charge and RSOs prior to issuing the range. The briefing will cover the requirements of this document as well as requirements of TAGMA PAM 350-2, *Range Safety and Trainers Guide*, and safety requirements from applicable weapons manuals, field manuals, and technical manuals.

Upon completion of range firing, units will police their brass, ammunition containers, and packaging. Using units remove expended cartridge casings from the range, visually inspect them to remove any live rounds, and turn over the expended casings to the Ammunition Supply Point (ASP). Other range residue such as weapons-cleaning materials and trash generated on the range will be collected on-site in a waste receptacle issued by Range Control upon check-in. The waste receptacle will be returned to Range Control upon checkout. Range control will establish a satellite accumulation point for wastes generated from weapons cleaning. Upon accumulation of 55 gallons of such waste, it will be disposed of per the Camp Edwards Hazardous Material and Waste Management Plan (HMWMP) and in compliance with state and federal solid and hazardous waste management regulations.

Specific Requirement: *All units/organizations using J, K, and T ranges will complete a Training Facility Utilization Report (**Section 8.2 and Appendix A**).* This report summarizes the training activities conducted on the range and includes: the weapons systems, the type and amount of ammunition, the firing lanes that were used, and the types of vehicles present on the range.

Specific Requirement: *After policing their brass and related range residue, Range Control personnel along with a unit representative will inspect the range using the Range Inspection Form (**Appendix B**).* This form includes a review of the general order and condition of the facility, a visual check of erosion and vegetation on the range, and a visual inspection of the STAPP™ system. Blank copies of both of these forms will be included in the check-in packet distributed at Range Control. Upon clearing J, K, or T Range, each unit/organization will submit the completed reports to Range Control. The Range Control Officer or authorized designee will be available to answer any questions that arise during the visual inspection, but it is the unit/organization's responsibility to complete the range inspection. Once the range is inspected and cleared by Range Control personnel, via signature on the inspection forms, the unit or organization representative will report to Range Control returning any packets or equipment issued and to close out the hand receipt prior to clearing the range.

7.4 Oversight of Training Operations

Per **Section 5.3**, the Range Control Officer is responsible for oversight of J, K, and T Range operations. The Range Control Officer issues and clears J, K, and T Range. He/she is the main point of contact for using units for range communications, usage requirements, and conflict resolution. The Range Control Officer will monitor units on J, K, and T ranges to support compliance with this plan and TAGMA PAM 350-2. The Range Control Officer will schedule all required monitoring described in **Section 11** and all maintenance described in **Section 9.0**.

Range Control will manage the ranges in accordance with Standard Operating Procedure (SOP) for STAPP™ System Range Maintenance Procedures and Inspections. The Range Control OIC is responsible for the distribution and implementation of this SOP (Chapter 10 of the Camp Edwards Range Control Internal SOP). The purpose of this SOP is to provide policies, procedures and guidelines to all Camp Edwards Range Control Soldiers on how to properly inspect, manage and repair the STAPP™ systems on Juliet, Kilo, and Tango Ranges. The Range Control Non Commissioned Officer in Charge (NCOIC) will review and train the Drill Team

NCOIC on the implementation and use of this SOP. Drill Team NCOIC's will then train and certify their assigned personnel on this SOP no later than 30 days after their training. Newly assigned personnel will be trained and certify on this SOP no later than 30 days after assignment. All Range Control Soldiers will review this SOP on an annual basis. All review and sign off sheets will be kept on file at Range Control.

Specific Requirement: *In the event that it is determined that any users of this SOP are unable to comply with any part of this SOP then the Range Control OIC must be notified within 24 hours upon this determination.*

The MAARNG environmental personnel will conduct site inspections at the request of Camp Edwards and or EMC in order to provide support and guidance for environmental protection at J, K, and T ranges. Environmental regulatory agencies may inspect the ranges and/or units for compliance with the OMMP.

Specific Requirement: *The regulatory agencies will be notified of range use through either the Range Control Weekly Range bulletin or email if range use was not posted in the bulletin.*

All personnel, including civilians, will contact Range Control before entering J, K, or T ranges. If conducting a range visit while the range is operational the personnel will first identify themselves to the Officer or NCOIC when entering the range.

8.0 RANGE INSPECTIONS

The ranges will be inspected periodically to ensure that pollution prevention equipment remains in place and is in good working order and to ensure that environmental conditions on the ranges are not degrading. This section describes the different types of range inspections and the frequency required of each type. A form for each type of inspection is provided in the Appendices of this plan. Range Control maintains the inspection forms for administrative record keeping. Each type of inspection is described in detail below and summarized in **Table 8-1**.

8.1 Pre- and Post-Firing Range Inspection/Clearance

Specific Requirement: *Before each time a range is used for live firing, a range inspection will be conducted by Range Control accompanied by the NCOIC or person in charge of the group using the range.*

This provides a chance to document pre-firing conditions and to acquaint the range users with the facilities and the expectations associated with range use. The inspection will include the firing line, range floor, target line, STAPP™ system, and other important features of the ranges. The parking areas will be inspected for general condition and any petroleum, oil, and lubricant stains from vehicles. The protective timber "toe berm boxes" behind the target frames will be evaluated to identify deterioration, damage or excessive amounts of undershot. Range Control and range users will note the condition of each of these features and any specific deficiencies in need of repair.

Specific Requirement: *The Range will then be inspected again after range use is complete to document the post-firing conditions. The form provided in **Appendix B-1** will be used to document the pre- and post-range firing inspections and to note any changes or discrepancies.*

8.2 Range Utilization Tracking

Specific Requirement: *Range users will fill out a Training Facility Utilization Report (**Appendix** A) at the end of each training day.* This form documents who uses the facility, how many personnel were trained, what they did, the quantity of rounds fired and other information important for tracking the use of the facilities. Each Report will be turned in to Range Control at the end of each training day.

8.3 Monthly Detailed Range Inspections

Range Control will conduct Detailed Range Inspections monthly.

Specific Requirement: *Detailed Range Inspections will also be completed within **2 business days** of significant storm events.*

These inspections will determine the condition of pollution prevention equipment and general range conditions. In particular, the conditions of the STAPP™ system and any protective cover will be closely monitored. The amount of water accumulated in the STAPP™ system will be measured and recorded. The form provided in **Appendix B-2** will be used to document the Detailed Range Inspections.

During the Detailed Range Inspection conducted each year in March, Range Control will take baseline condition photos every third year of the firing lines, range floors, soil berms, and bullet containment systems while standing at firing positions 4 and 13. These and previous baseline photos will help field crews evaluate observed conditions against the baseline and help document the rehabilitation of any reported range deterioration. Range Control will maintain a photo log (**Appendix B-3**) using the baseline condition photos and any rehabilitation photos. The photo log will be maintained and updated every three years and will include the date, time, direction, and any pertinent site notes associated with each picture.

8.4 STAPP™ System Internal Inspections

The conditions inside the STAPP™ system will be inspected and documented when the STAPP™ cover is removed for maintenance and/or periodic bullet removal. Typically, this is done *after 500,000 rounds have been fired on J and T Ranges and after 750,000 rounds at K Range* unless it is determined in conjunction with the regulatory agencies that removal is not needed. This inspection can also be conducted more frequently if conditions warrant. The form provided in **Appendix B-4** will be used to document the Detailed STAPP™ Inspections.

8.5 Unannounced Inspections

The EMC and EPA may conduct unannounced independent inspections of J, K, and T ranges as needed. All personnel, including regulatory personnel, must check in with Range Control prior to visiting the ranges. If inspections occur during range use, the inspector should identify themselves to the person in charge at the range and follow all safety procedures and requirements of the range users. EPA and EMC may complete the form provided in **Appendix B-1** or a similar form of their own to document the inspections and provide the form to Range Control for inclusion in the inspection record. To ensure that all deficiencies identified during an inspection are addressed, Camp Edwards will provide a formal response to inspections reports submitted by regulatory agencies within 5 business days.

8.6 Inspection Summary

The following table, **8-1**, summarizes all maintenance activities and the frequency in which they will occur.

Table 8-1. Summary of Inspections

Frequency	Type of Inspection	Responsible office	Activity	Form to be used
Each day of range use Pre- and post-firing	Visual inspection of - STAPP™ cover - Parking area - Toe boxes - General range conditions	Range Control with person in charge of range users	Range Control and the range users inspect the range together before and after use, note any changes	Range Inspections/ Clearance Checklist (See Appendix B-1)
Each day of range use	Record daily facility use including - # of personnel, - # of rounds fired,	OIC or person in charge of range users	Range user submits after training. Record areas used, activities, and ammunition expended	Training Facility Utilization Report form (Appendix A)
Monthly and after significant storm events	Detailed inspection of - Range floor - STAPP™ - STAPP™ Water level - Berm - Toe Berm Boxes - Erosion/Vegetation	Range Control	Detailed inspection of STAPP™ system and Range to determine if any maintenance is required	STAPP™ Detailed Inspection Form (see Appendix B-2)
Every three years, typically during March	Photographs of the general condition of the range	Range Control	Photographs of the Firing line, berm, STAPP™ system, range floor	Range Control Photo log (see Appendix B-3)
After 500,000 rounds have been fired on J and T Ranges and after 750,000 rounds at K Range	Internal inspection of STAPP™	Range Control	Inspect the conditions inside the STAPP™ system and remove/recover bullets	STAPP™ System Internal Inspection Form (see Appendix B-4)
Unannounced	Visual inspection of range conditions, observe training	Regulatory Agencies	Regulatory agencies visit the site after checking in with Range Control Camp Edwards responds to inspection findings within 5 business days	Range Inspections/ Clearance Checklist (See Appendix B-1)
As needed	During range maintenance activities	Range Control	Document activities	Range Maintenance/ pH Testing/Lime Spread Form (Appendix B-5)

9.0 RANGE MAINTENANCE

Camp Edwards will conduct periodic maintenance on J, K, and T ranges to ensure design features and pollution prevention measures remain in adequate condition to support training requirements and ensure that the BMPs function as intended. To the maximum extent possible, maintenance will be conducted during off-peak training periods (between October and April). This preventative maintenance will be conducted as needed, regardless of other maintenance schedules.

All maintenance and repairs conducted on J, K, and T ranges will be documented using a Range Maintenance/ pH testing/Lime Spread Form (**Appendix B-5**) and then filed in the maintenance log at Range Control.

All maintenance and field work conducted at the ranges will be conducted in accordance with a health and safety plan that specifically addresses the potential risks associated with metals exposure at the ranges.

9.1 Erosion

Erosion is the displacement of soil by wind or water or any movement in response to gravity or human activity. J, K, and T ranges are generally flat, with the exception of the STAPP™ berms. The potential causes of erosion on J, K, and T ranges are lack of vegetation, and human activity/disturbance, such as staff climbing the vegetated berm to inspect the STAPP™ systems. Eroded areas will be repaired and, if necessary to prevent reoccurrence, measures will be taken to stabilize the soil. Should an area of significant erosion of a berm serving as a backstop be identified, repairs will be made as soon as feasible. Should such erosion be identified immediately prior to a firing event, the lane or lanes impacted will not be used until repairs are made.

9.2 Vegetative Cover and Windbreaks

Healthy vegetative cover prevents erosion and provides organic material that can aid in reducing metals mobility. Camp Edwards will plant, as needed, an approved native seed mix to provide vegetative cover on berm areas and range floors. To establish proper vegetative cover on J, K, and T ranges all seeding and planting should occur early spring and or fall (April and/or October).

Forested buffers, serving as natural windbreaks and noise abatement, will be maintained around J, K, and T ranges. Camp Edwards will trim tree limbs on the range boundaries. Any diseased or dead trees may be removed, as advised by the MAARNG's Natural Resource Program/Environmental Office.

9.3 Storm Water Management

On J and K ranges, there is a gently sloping drainage swale at the toe of each berm. Surface water flows through the swales and, where necessary, through underground drainage pipes to drainage basins. The drainage basins are lined with limestone riprap. These systems will need periodic maintenance to keep them in working condition. The drainage swales lined with riprap will be kept free of vegetation and the proper grade will be maintained to conduct surface water flow away from the ranges. There are no drainage structures on T Range.

9.4 pH

Lead styphnate and antimony sulfide are components of the propellant primer in the bullet cartridges that are used on J, K, and T ranges. Therefore, concentrations of lead and antimony may accumulate on the range floor over time, especially near the 25-meter firing line. As of 2013, lead and antimony concentrations near the firing lines remain at background concentration.

When pH levels are near neutral (6 to 8.5), the corrosion and solubility of lead is minimized and solid lead remains relatively unavailable for migration through the soil to pore water. Therefore, neutral pH in soil and pore water may help prevent metals migration on the ranges. pH levels above 8.5 tend to increase the potential for lead and antimony solubility and migration.

Camp Edwards has managed the soil and pore water pH on the ranges through soil amendment with lime with the goal of maintaining soil and pore water pH in the range of 6 to 8.5. Lime additions during the first several years of range operations have brought the pH on the range floors of the soil up to the desired range in most places. The pore water on the ranges has responded similarly with most pH readings in the lysimeters between 5.5 and 7.0.

Camp Edwards will continue to test soil pH on each range annually. To determine the average soil pH, 6 locations within 5 meters of the firing line at each range will be probed with a handheld pH-reading field instrument to a depth of up to 2 inches. The average of the 6 readings will be calculated for each range. The same process will be followed along the toe of the berm between the target frames and the toe berm boxes.

Pore water pH will also be monitored annually. The pH in each lysimeter will be recorded with field instrumentation from pore water purged from the bucket lysimeters during the annual environmental sampling described in **Section 11.0.**

As per EMC/Science Advisory Council recommendations, further addition of lime has been suspended until further notice.

If the bullet cartridge primer formulation is changed to eliminate lead and antimony, it may be desirable to have no further pH testing or additions of lime. This will be discussed with the regulatory agencies and Camp Edwards before any changes are made. Any such change will be documented in an OMMP.

10.0 BULLET CONTAINMENT SYSTEM MAINTENANCE AND METRICS

The condition of the bullet containment systems will be closely monitored and necessary maintenance and repairs will be conducted in accordance with the metrics outlined below. A number of features of the STAPP™ bullet containment systems will be monitored to contain metals and sever potential migration pathways. These features include:

- the tarp (covers the top rubber membrane)
- the rubber membrane cover (faces and seams),
- the rubber filler material,
- the impermeable liner,
- the internal water reservoir, and
- the synthetic lumber support structure
- the toe berm boxes.

<u>General Requirement</u>: *If repairs cannot be scheduled or initiated within **5 business days** of inspection then all appropriate MAARNG leadership and appropriate federal and state environmental agencies will be notified in writing (email, or letter) within **3 business days** of this determination unless, where applicable within **Section 10**, the STAPP™ system is covered with tarps to prevent exposure of the STAPP™ system to the environment until the repairs are made prior to subsequent range use. If it is determined that repairs needed preclude the use of any lane or the range in total Range Control will shut down part or all of the range, providing for safety and environmental protection.*

10.1 Rubber Membrane Cover (Faces and Seams)

The rubber membrane cover is the top layer of the STAPP™ systems. Although the rubber membrane that covers the granular rubber is relatively "self-closing" it can become worn and perforated to the point where significant amounts of precipitation can accumulate within the system. The wear and perforation of the rubber membrane is heavily dependent upon range use. Both the frequency of operations at the range and the caliber of projectiles used in training will affect the useful life of the rubber membrane. **Figure 10-1** depicts the progression of wear and perforation on a heavily used STAPP™ system over a number of years.

Figure 10-1. Examples of Wear and Deterioration, Rubber Membrane Cover, STAPP™ System
(Photo not taken at Camp Edwards)

Holes in the Cover: MAARNG will inspect the rubber membrane in accordance with the range inspections outlined in **Section 8**. If granular rubber media is exposed the cover is not preventing exposure of bullets to air and water. As such repairs should be made in accordance with the metric below. This applies to all holes created by firing as well as any other occurrence that may cause holes, tears, seam failures or the like.

Specific Requirement: *When underlying rubber media is visible, repairs will be scheduled to occur within* ***5 business days*** *of inspection unless the STAPP™ system is covered with tarps to prevent exposure of the STAPP™ system to the environment until the repairs are made prior to subsequent range use.*

The following steps will be taken to repair holes or tears to the self-closing rubber membrane cover of the STAPP™ when granular rubber filler material is clearly visible through external inspection.

1. Clean/brush damaged area off
2. Using a caulking gun, apply a bead of the LOCTITE 5510 Elastic Adhesive directly over the hole or along the seam failure or apply under a patch of matched material.
3. Apply hand-pressure to surrounding areas to ensure that enough adhesive has been applied.
4. Smooth and wipe off excess.

The time required to complete minor repairs is generally less than 10 minutes. Larger repairs may require up to 30 minutes. During use the glue container will be handled such that there is no release of material to the environment. The container will be put in secondary containment when not in use during seam repair.

Failed Seams in Rubber Membrane Cover: Seam failure is most problematic in the bottom one foot of the STAPP™ system, near the base. In this area, the cover gradient is less steep than throughout the rest of the system and at times water may pond on the top of the rubber membrane cover. If the cover has a seam failure in the lower portion of the STAPP™, ponding water could penetrate the cover and accumulate in the water collection system. Larger seam failures can also be problematic in the upper portions of the STAPP™ system as seam failures will also allow precipitation to leak into the system.

Specific Requirement: *Failed seams occurring above the bottom one foot of cover (where water is not likely to pond on the membrane) require repair if the seam failure exceeds 6 inches. Failed seams occurring at/near the toe (within the bottom one foot) require repair if greater than one inch in size. Repairs will be initiated as soon as possible within **5 business days** of inspection, weather permitting, unless the STAPP™ system is covered with tarps to prevent exposure of the STAPP™ system to the environment until the repairs are made prior to subsequent range use.*

Top Cover Surface Ponding: Settling of the self-closing cover may occur. If this settling becomes a depression, water may pond on the top of the rubber membrane cover in this area. Ponding water may seep into the STAPP™ system through failed seams or holes in the cover.

Specific Requirement: *Differential settling of the STAPP™ material resulting in four or more liters of rain water ponding in an area of the cover requires repair. The ponded water will indicate a need to "regrade" or "rake" the rubber filler material to an even-level distribution across the settled area(s) of the STAPP™ system to promote proper runoff. Repairs will be initiated within **5 business days** of inspection, weather permitting, unless the STAPP™ system is covered with tarps to prevent exposure of the STAPP™ system to the environment until repairs are made prior to subsequent range use.*

10.2 Rubber Filler Material

The rubber filler material is approximately 18 inches of loose, granular rubber fill situated below the rubber membrane cover. Irregularities in the surface of the STAPP™ system may be indicative of two different problems: (1) irregular distribution or settling of the granular rubber media, causing "thin-spots" and poor bullet-stopping capacity; or (2) erosion or irregular settling of soil beneath the STAPP™ system causing stretching or other stresses that may damage the impermeable liner.

Specific Requirement: *A bulge or depression that exceeds 4 inches in height/depth over a length of 4 feet will be considered "significant" and will be repaired. Irregular settling will be measured using a 4-foot-long straight edge placed on the surface of the self-closing cover. Separation of 4 inches between the straight edge and the cover of the STAPP™ will indicate a need to "re-grade" or "rake" the rubber filler material to an even-level distribution across the STAPP™. Major repairs of granular rubber layer may require a contracted specialist. Repairs of erosion or irregular settling of soil beneath the system will, in general, require a contracted specialist to complete necessary repairs. Scheduling of contracted work will be executed as soon as funding and scheduling will allow. Minor in-house repairs of the granular rubber will be initiated as soon as possible within **5 business days** of inspection, weather permitting, unless the STAPP™ system is covered with tarps to prevent exposure of the STAPP™ system to the environment until the repairs are made prior to subsequent range use. Deficiencies requiring major repairs would also render the range or lanes, as appropriate, unavailable for training until repairs are completed.*

10.3 Impermeable Liner

The impermeable liner is situated below the rubber filler material in the STAPP™ system and lies directly on the surface of the earthen berm. **Figure 10-2** shows punctures in the impermeable liner beneath a STAPP™ system caused by .762 caliber projectiles. MAARNG will inspect the impermeable liner for punctures and tears each time the granular material is sifted to remove and recover captured projectiles or at some other frequency as approved by EPA and EMC.

Specific Requirement: *The liner must be inspected when rubber media is removed for replacement and or metals recovery. Any perforations, holes, rips, or seam failures in the impermeable liner will be repaired. Repairs of this nature will likely require a contracted specialist. The STAPP™ system would be covered with tarps to prevent exposure of the STAPP™ system to the environment until the repair is made. Scheduling of contracted work will be executed as soon as funding and scheduling will allow. Deficiencies of this nature would also render the range or lanes, as appropriate, unavailable for training until repairs are completed. Minor in-house repairs will be initiated as soon as possible within **5 business days** of inspection, weather permitting unless the STAPP™ system is covered with tarps to prevent exposure of the STAPP™ system to the environment until the repairs are made prior to subsequent range use. The MAARNG will notify the EPA and the EMC of the scheduled liner repair work **2 business days** prior to the start of repairs.*

Figure 10-2. Example of Perforated Liner, Tango Range

10.4 Internal Water Reservoir System

External Visual Inspection: Units and Range Control will conduct a visual inspection of the ground surrounding the STAPP™ water reservoir at the bottom of the berm to check for any leaking.

Specific Requirement: *Any leaking will be immediately contained. Repairs will be initiated within **72 hours** of inspection, weather permitting, and the STAPP™ system will be covered with tarps to prevent further accumulation and release of additional liquid.*

Internal Visual Inspection. The internal water reservoir system is situated at the base of the STAPP™ system. It allows water to be collected and be removed (**Figure 10-3**). The water reservoir system will be checked for excess water, punctures or cracks. Proper inspection of the impermeable liner and the internal water reservoir requires removal of the self-closing cover and displacement of some of the granular rubber material. This process will also require redistribution of the granular rubber across the system and resealing the rubber membrane cover around the edges of the STAPP™ system. MAARNG will inspect the internal reservoir system for punctures and cracks each time the granular material is sifted to remove and recover captured projectiles (i.e., after 500,000 rounds have been fired on each range or every three years, whichever occurs first) or at some other frequency as approved by EPA and EMC.

Figure 10-3. Internal Water Collection Reservoir System

10.5 Synthetic Lumber Support Structure

The synthetic lumber support structure makes up the frame surrounding the rubber granular material and holds the impermeable liner and self-closing cover in place. **Figure 10-4** illustrates damage to the support frame for the installed bullet containment system. Damage to the STAPP™ support frame will be repaired on an as-needed basis.

Figure 10-4. Example of Damage to STAPP™ Support Frame
(Photo not taken at Camp Edwards)

10.6 Water from Bullet Containment System

The MAARNG will collect through the access port, **Figure 10-5**, and properly dispose of the liquid that accumulates in the corrugated plastic reservoirs within the STAPP™ systems after 15 or more cm of water accumulates in the reservoir. The water will be removed within 72 hours after the reading exceeding 15 cm is taken. The water level will be inspected after all significant weather events. Camp Edwards will identify and coordinate with the receiving treatment and disposal facility to determine the appropriate analytical methods for testing the water. Based on the results of this sampling, Camp Edwards will dispose of the water in accordance with all applicable state and federal laws and regulations. In no cases will water from the STAPP™ system reservoir be discharged onto the ground on the Range.

Figure 10-5. STAPP™ System Water Access Port

Specific Requirement: *Camp Edwards will collect and properly dispose of the liquid that accumulates in the corrugated plastic reservoir within the STAPP™ system after* ***15 cm*** *of water accumulates in the reservoir. Water removal from the internal reservoir will occur within* ***72 hours*** *of inspection, weather permitting.*

10.7 Tarps Covering STAPP™ Systems

Impermeable tarps will be placed over the STAPP™ systems and secured with sand bags when precipitation is expected and the range is not in use. These tarps have been shown to greatly reduce the amount of rain water that enters the STAPP™ systems. The tarps must be removed by the using units or by range control prior to firing on the range.

Specific Requirement: *Camp Edwards will maintain and keep secure, on the STAPP™ system, a tarp that will prevent water from infiltrating the system. The tarp will be kept in good repair with tears and holes repaired, and the tarp itself kept secured to the STAPP™ system.*

10.8 Toe Berm Boxes

Toe berm boxes are a series of sand-filled timber framed boxes that will be/have been placed behind the target frames to protect, from undershot, the base of the STAPP™ system and its water reservoir from reflexive fire on Juliet and Kilo Range and all firing on Tango Range (**Figure 10-6**). The boxes are filled with sand. The tops of the toe berm boxes are treated with a weather sealant to shed rain water.

Figure 10-6. Toe Berm Boxes at Tango Range.

Specific Requirement: *Camp Edwards will maintain toe berm boxes to prevent undershot from compromising the STAPP™ System water reservoir. The boxes will be maintained to contain sand, and be filled with sand and or sand bags. The tops of the toe boxes will be maintained to shed rain water. The integrity of the box will be examined to determine if the box is capable of containing and still contains its sand filler. The rear of the toe berm boxes will be examined during inspections to insure that projectiles have not passed through the box. If a particular box shows evidence structure failure and or of projectile penetrations on the rear of the box then that lane will be shutdown from reflexive fire on Juliet and Kilo Ranges and all fire on that lane at Tango Range until the box can be repaired.*

10.9 Periodic Metals Removal

Specific Requirement: *The MAARNG will periodically remove bullets from the STAPP™ systems; bullets will be removed after 500,000 rounds have been fired on J and T Ranges and after 750,000 rounds at K Range or as approved by EPA and EMC. After 400,000 rounds on J* *and T ranges and 650,000 rounds on K Range the MAARNG will notify EPA and the EMC, request funding, and begin the contracting process for periodic metals removal. In coordination with USEPA and the EMC Camp Edwards will continue to use the STAPP systems until metals removal work begins.*

The MAARNG or its representative will use either the specially designed STAPP™ sifter, or a compatible system, for removing metals from the STAPP™ system. The STAPP™ sifter consists of a table positioned at a defined slope with a small vibrator positioned on the underside of the table. The granular rubber and bullet mixture is placed onto the table, and due to the vibration slowly moves down the slope of the table. A piece of piping at the end of the table is connected to a cyclone vacuum with a high-efficiency particulate air (HEPA) filter. The vacuum has enough suction to remove the granular rubber but not the bullets. The granular rubber is sucked up via the cyclone and the air is filtered with a HEPA filter (**Figure 10-7**).

Figure 10-7. STAPP™ Sifter

The total mass of metals removed from the bullet containment system will be compared with the total computed mass loading of bullets fired on the range from the Training Facility Utilization Reports (**Appendix A**). This comparison is indicative of the general efficiency with which the STAPP™ system eliminates the source of metals on the ranges (some metal is returned as fragments/particulates with the granular rubber).

This process must be conducted with appropriate environmental protections as required. At a minimum, secondary containment must be placed in all active work areas where metal removal will occur. Prior to work beginning, contractors or in house personnel conducting this work will coordinate with Range Control and the MAARNG Environmental Office to ensure that the proper environmental protections are in place. Also, this process must not be conducted during precipitation events or high winds.

Specific Requirement: *The MAARNG will notify the EPA and the EMC of the scheduled work at least **2 business days** prior to start.*

11.0 ENVIRONMENTAL MONITORING

Camp Edwards will monitor groundwater, pore water, and surface soils at the three ranges. The goal of the monitoring is to determine when range maintenance activities are needed to protect the environment and promote range sustainability. All sampling conducted at the ranges will be done in accordance with a health and safety plan that specifically addresses the potential risks associated with lead/antimony exposure at the range.

Specific Requirement: *Camp Edwards and the sampling contractor will notify the EMC, MassDEP, and EPA at least **2 business days** in advance of any sampling event so that they can observe the sampling event and conduct split sampling if necessary.*

The environmental sampling (soil, porewater, and groundwater) rotation for Juliet, Kilo, and Tango Ranges can be found in Appendix C.

11.1 Data Reporting

Data validation will be completed at the Tier I and Tier II level for all data. Ten percent of the data will be validated at the Tier III level.

Specific Requirement: *Unvalidated (i.e. draft) data will be forwarded to the regulatory agencies within **2 business days** of receipt by the MAARNG. The results of sampling will be compared to the action levels presented in **Tables 11-1, 11-2, and 11-3** and any increase in concentrations will be noted in the results submittal. If an unexpected result exceeds an Action Level specified in **Tables 11-1, 11-2, or 11-3**, resampling may be conducted to confirm the result. Any concentrations exceeding the action levels will be noted in the results submittal and a proposed plan for re-sampling, if needed to confirm an exceedence, will be included pending data validation. Validated data will be forwarded to the regulatory agencies as soon as feasible within **7 business days** of receipt.* Validated data is normally received by the MANG 4-6 weeks after sampling occurs.

11.2 Groundwater

Samples of the groundwater wells down gradient of the active portion of the ranges will be taken annually. Samples will be collected in the summer (July/August).

Unfiltered samples will be collected to determine the concentrations of potential range contaminants occurring in solid and dissolved form within the aquifer. Camp Edwards may, at its option, also analyze filtered samples to determine if detected metals are in dissolved or solid form in groundwater. The groundwater samples will be analyzed for lead, copper, and antimony using method SW6020A.

Groundwater monitoring wells to be sampled include MW-471S and MW-472S at J Range, MW-474S at Kilo Range, and MW-467S at T Range. Typical well construction details of a groundwater monitoring well are shown below on **Figure 11-1**. **Figures 11-4, 11-5, and 11-6** indicate the locations of the groundwater monitoring wells on J, K, and T ranges.

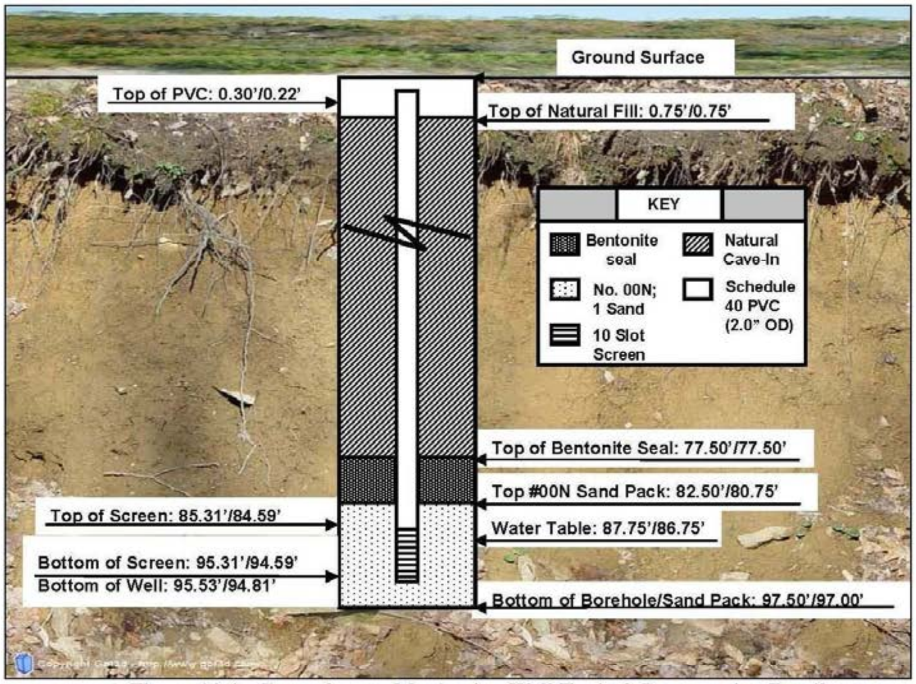

Figure 11-1. Groundwater Monitoring Well Typical Construction Details

11.3 Pore Water Lysimeters

Several pan lysimeters have been installed on the range floors at J, K, and T ranges to determine the concentrations of range related metals in pore water. The lysimeters(s) at the toe of the berms will detect whether metals from fired ammunition are contained by the STAPP™ system. These lysimeters are buried approximately two to six feet below the ground surface. If chemical constituents begin to percolate through the pore water toward the aquifer, the lysimeters will provide an early warning.

Additional lysimeters have been installed at the same depth near K Range and T Range but behind the firing line to determine the naturally occurring concentrations of potential range related metals in pore water.

The pan lysimeters are made of HDPE buckets with a fine mesh cover. Water percolating through the soil accumulates in the bucket and can then be pumped to the surface for sampling. Poly tubing is connected to the lysimeter and run to the surface. Pore water is extracted through this tubing with a peristaltic pump. Another poly tube provides a vent for pressure equalization. A protective cap placed at the end of the sleeve allows the tubing to be kept slightly below ground surface, but still accessible for sampling (**Figures 11-2 and 11-3**)

In the summer of each year (July/August), the lysimeters will be sampled. While samples are being collected, the pH of the water will be measured. Unfiltered samples will be analyzed for total copper, lead and antimony by method SW6020A. Camp Edwards may, at its option, also analyze filtered samples to determine if detected metals are in dissolved or solid form. This can be especially important when testing for metals in lysimeters because there is no built-in filter to remove sediments that naturally contain metals at background concentrations.

Background lysimeters are intended to help determine the naturally occurring pore water conditions. The background lysimeters will initially be sampled and the pH recorded in conjunction with monitoring of the lysimeters on the ranges. Further pH monitoring and/or metals analyses of samples from the background lysimeters will be done as needed. **Figures 11-4, 11-5, and 11-6** indicate the locations of the lysimeters on J, K, and T ranges.

Figure 11-2. Pan Lysimeter

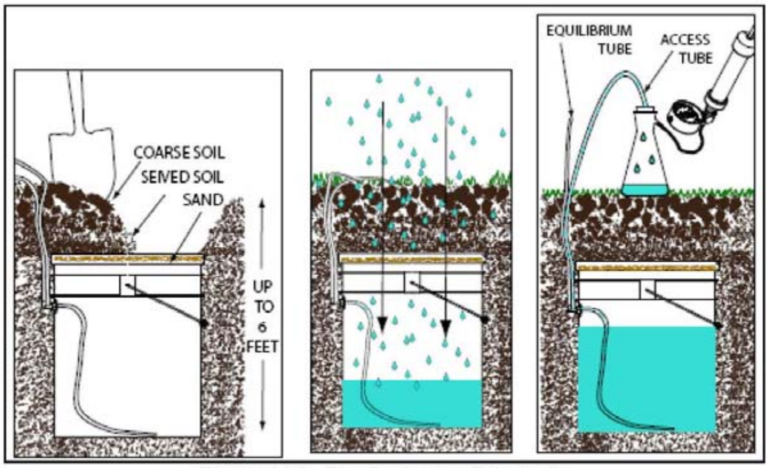

Figure 11-3. Pan Lysimeter Schematic

11.4 Surface Soil

Camp Edwards will sample surface soil on the ranges between the 25-meter firing lines and the toe of the berms. Each range will be sampled biennial with samples collected in July/August. For example, J Range may be sampled during even numbered years and K and T ranges may be sampled during odd numbered years.

The range floors will be divided into six sample areas that are each 5 meters long and the full width of the range. The first sample area (Area 1) will begin at the firing line and subsequent 5 meter wide areas will progress downrange to the STAPP™ berm (Area 6). The actual size of Area 6 may be adjusted as needed to cover the entire area between the target line and the bottom of the STAPP™ system. **Figures 11-4, 11-5, and 11-6** show the locations of the sampling areas on J, K, and T ranges respectively.

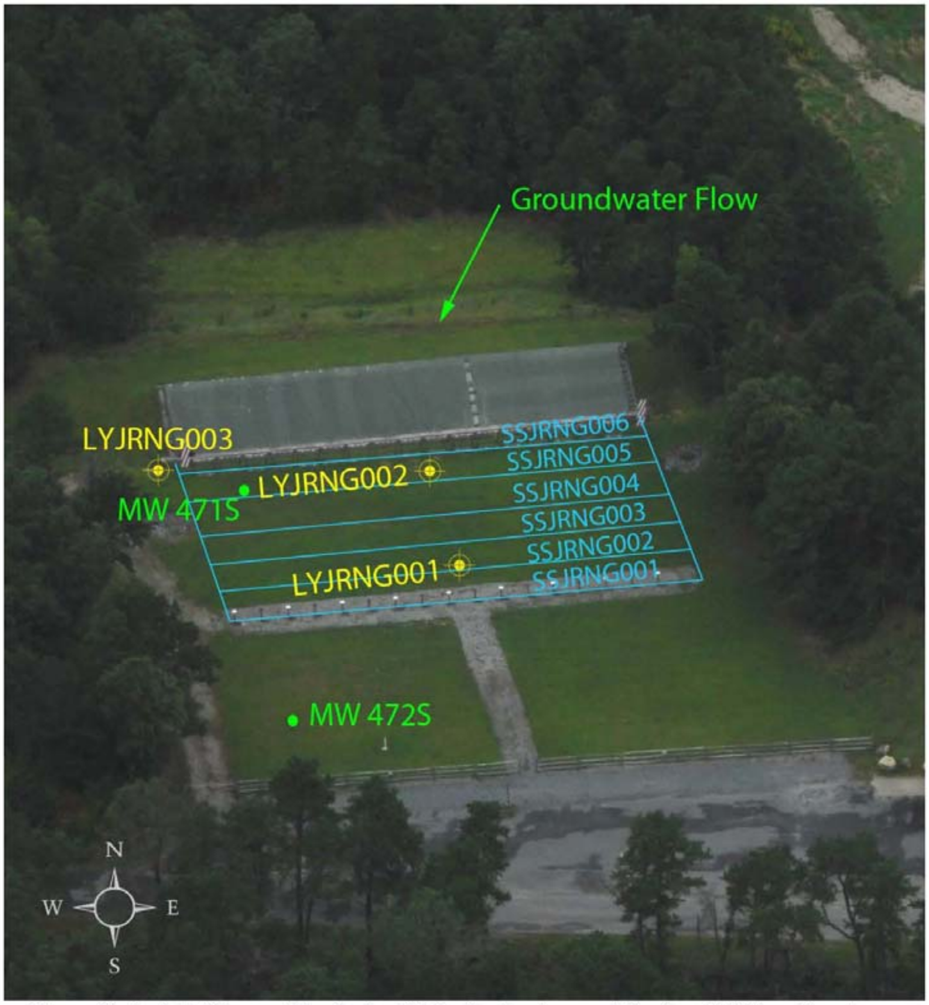

Figure 11-4. Juliet Range, Monitoring Wells, Lysimeters, and Surface Soil Sampling Areas

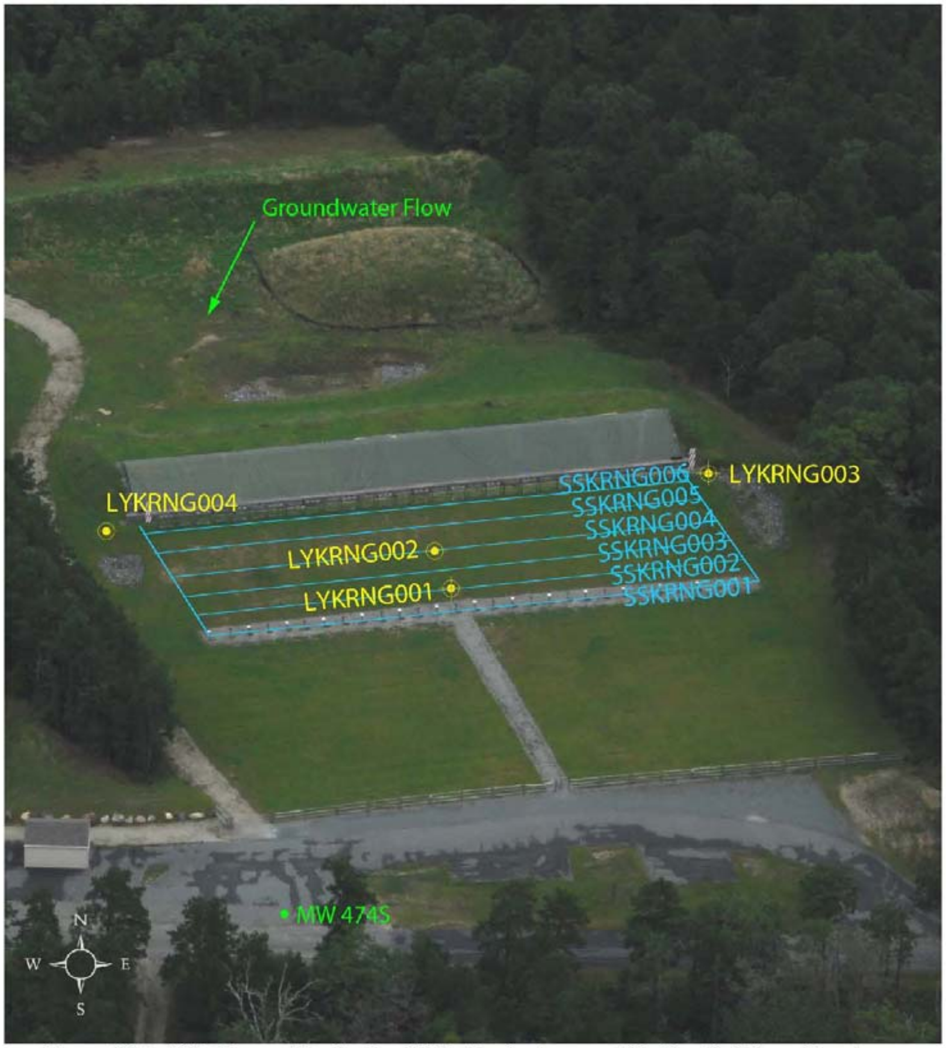

Figure 11-5. Kilo Range, Monitoring Wells, Lysimeters, and Surface Soil Sampling Areas

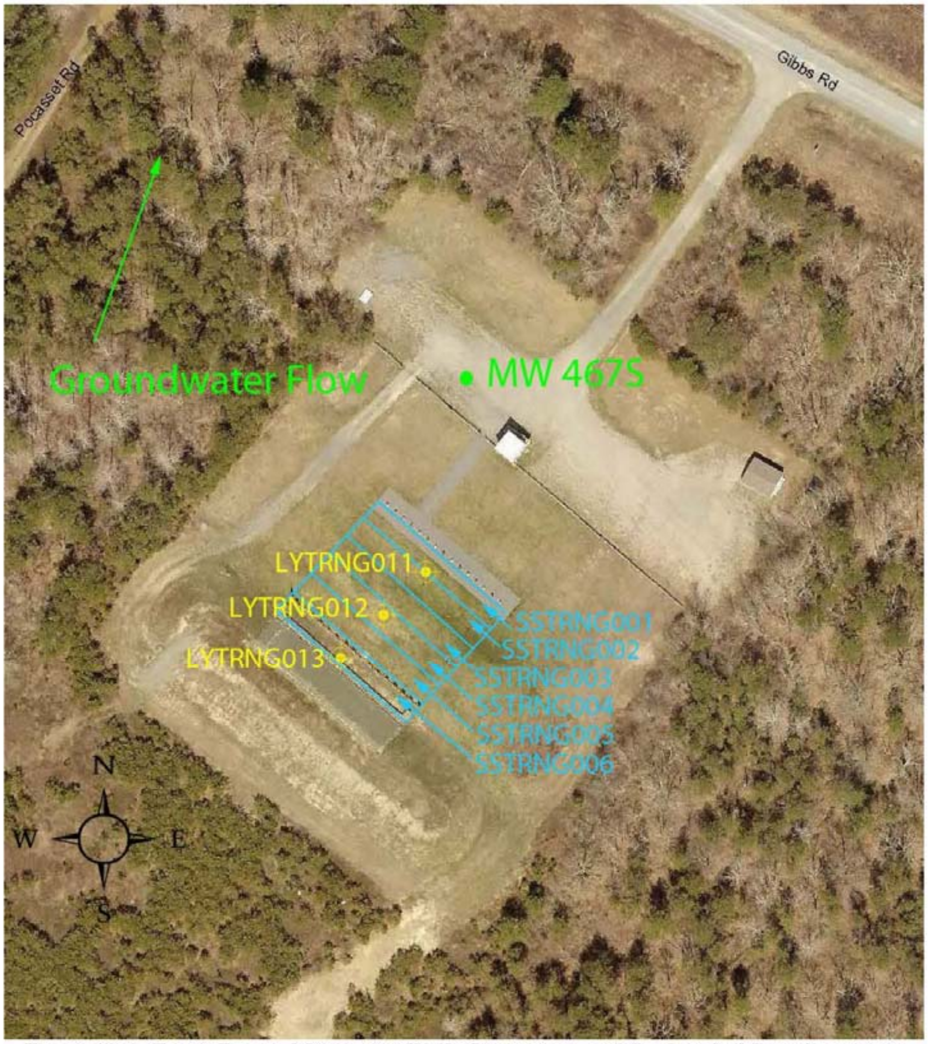

Figure 11-6. Tango Range, Monitoring Wells, Lysimeters, and Surface Soil Sampling Areas

A 100-point multi-increment sample (MIS) will be collected from a depth of 0-3 inches from each sample area according to Cold Regions Research & Engineering Laboratory (CRREL) recommendations. All samples are to be collected by trained professionals using a systematic random sampling method. As per CRREL recommendations, this requires dividing the sample area into exactly as many sub-areas as the number of increments required for the sample. One increment is collected from each sub-area. The same relative location should be used for each sub area. For example, if the center of the first sub-area is used to collect the first soil increment, the center of each following sub-area should also be used until the sample is complete. Samplers will use a plug extractor to systematically collect representative samples from each grid and will not concentrate samples in one portion of the sampling grid.

Two replicate samples, in addition to the primary sample, will also be collected for quality assurance purposes from the sample area closest to the firing line each time soil samples are collected from a range. Replicate samples should be collected in the same way as the primary sample, but from different locations within the sub-areas. Replicates can be collected at the same time if practical. Decontamination between replicates or between sub-areas is not necessary since all three samples are characterizing the same sample area. Decontamination is required before beginning to sample a different area. The relative percent difference (RPD) of the three samples will be calculated and the result will be included in the draft data submittal. If the RPD is greater than 25%, the soil sample collection protocols should be reconsidered to achieve better repeatability of the field sampling method. This could include either collecting more sub-samples in each sample to be analyzed or using smaller sample areas. Revised sampling methods will be determined in conjunction with the regulatory agencies.

Samples will be prepared for analysis using CRREL standard methods for mixing and drying. The samples will be ground to a fine powder prior to digestion. From these samples, 2 grams of homogenized soil will be removed and digested according to method 3050B Nitric Acid Digestion for Soils. The samples will be analyzed for copper, lead, and antimony using method SW6010B.

The results will be used to track the accumulation of lead and antimony from the propellant primer formulation used in the bullets and to determine when range maintenance is needed to reduce the metals concentrations. If the primer formulation is changed to eliminate lead, one soil sampling event will be conducted after the last lead/antimony-containing primer is used.

11.5 Triggers for Maintenance Actions

Based on the results of soil, pore water, and groundwater monitoring described above, Camp Edwards will initiate maintenance actions to prevent or address pollution. The need for range maintenance actions will be indicated by comparing soil, pore water, and groundwater monitoring results to a series of action levels.

The surface soil Action Levels for lead, copper, and antimony are set using selected concentrations from the Massachusetts Contingency Plan. These values are not necessarily directly applicable to active small arms ranges, but they provide a framework for comparison to concentrations that are considered potentially hazardous in some situations. The action levels for surface soil are provided in **Table 11-1**.

Table 11-1. Surface Soil Action Levels

Analyte	
Lead	3,000 mg/Kg
Antimony	300 mg/Kg
Copper	10,000 mg/Kg

mg/kg= milligrams per kilograms or ppm

Soil Action Level Exceedence: Soil monitoring results will be compared to the Action Levels. If a result exceeding an Action Level was not expected or appears to be anomalous, the sample area can be re-sampled in duplicate with both samples analyzed to determine if the original result is representative of actual site conditions.

Specific Requirement: *Re-sampling, if needed, should occur within **1 month** of receiving the original validated laboratory data, unless additional time is needed to secure funding and award contracts, at which time the regulatory agencies will be notified of the delay within **2 business days**. Resampling with an XRF field instrument with applicable detection limits may be proposed as an alternative to supplement the soil sampling and laboratory analysis.*

If an exceedence of the action levels is accepted or confirmed through resampling, surface soil in the applicable area will be removed and replaced so that the potential for migration of the contaminant is reduced. MAARNG will coordinate with the regulatory agencies to identify appropriate soil removal or other maintenance actions. Soil excavation, if needed, should occur prior to the next training season.

If the resampling demonstrates that the actual concentration does not exceed the Action Level, soil removal is not needed.

Pore water action level numbers are based on drinking water standards because the pore water is monitored as an early warning of potential groundwater impacts. Drinking water standards are not applicable to pore water but they provide a framework for comparison to concentrations that are potentially hazardous if they were to migrate all the way to the aquifer. Action levels for pore water are provided in **Table 11-2**.

Table 11-2. Pore Water Action Levels

Analyte	
Lead	15 ug/L
Antimony	6 ug/L
Copper	1300 ug/L

ug/L= micrograms per liter or ppb

Pore Water Action Level Exceedence: Pore water monitoring results will be compared to the Action Levels. If a result exceeding an Action Level was not expected or appears to be anomalous, the lysimeter can be re-sampled in duplicate with both samples analyzed to determine if the original result is representative of actual site conditions.

Specific Requirement: Re-*sampling, if needed, should occur within* ***14 days*** *of receiving the original validated laboratory data, unless additional time is needed to secure funding and award contracts, at which time the regulatory agencies will be notified of the delay within* ***2 business days***.

If the exceedence of the action level is accepted or confirmed through resampling, the surface soil in the lysimeter sample area will be removed and replaced. The monitoring results of other lysimeters on the range and the results of soil monitoring should be used to help define the horizontal extent of the excavation needed. MAARNG will coordinate with the EMC and regulatory agencies to identify appropriate soil removal or other maintenance actions. Soil excavation, if needed, should occur prior to the next training season.

If the resampling demonstrates that the actual concentration does not exceed the Action Level, soil removal is not needed.

Groundwater action levels are set equal to one half of the drinking water standard because a detection of range related metals in groundwater at these concentrations would indicate a potentially significant and unexpected occurrence and response actions should be taken before concentrations exceeding safe drinking water concentrations occur. Action levels for groundwater are provided in **Table 11-3**.

Table 11-3. Groundwater Action Levels

Analyte	
Lead	7.5 ug/L
Antimony	3 ug/L
Copper	650 ug/L

ug/L= micrograms per liter or ppb

Ground Water Action Level Exceedence: Detection of range related metals in groundwater at concentrations exceeding the Action Levels would be an unexpected occurrence. If a groundwater Action Level appears to be exceeded, the location of the detection may be resampled in duplicate to determine if the original result is representative of actual site conditions.

Specific Requirement: *Re-sampling should occur within* ***14 days*** *of receiving the original validated laboratory data unless additional time is needed to secure funding and award contracts, at which time regulatory agencies will be notified of the anticipated delay within* ***2 business*** *days and an alternate schedule will be proposed. If resampling indicates that the original result was not representative and the action level has not been exceeded, no further response is needed and range use would continue.*

Groundwater concentrations at or above the Action Levels that have been confirmed by re-sampling require significant actions that may include a suspension of range use and reassessment of the pollution prevention program. In order to reduce contaminant sources and prevent further impact to the groundwater, the surface soil at the range may be removed and replaced. The extent of soil removal would be determined in conjunction with soil and pore water sampling results. Additional investigation to determine the extent of soil removal may be appropriate. Soil excavation, if needed, should occur prior to the next training season. Response actions and further range use will be coordinated with the regulatory agencies.

12.0 NOTIFICATION AND REPORTING REQUIREMENTS

If the MAARNG determines or anticipates that it may not be able to comply with any requirement or metric (including sampling, reporting, and range management) of the approved OMMP, MAARNG will within **2 business days** of this determination notify the regulatory agencies in writing, and any corrective action that has been taken or will be taken. Where needed, within an additional **7 business days**, submit a plan for approval for further addressing the potential deviation from the approved OMMP. The following protocol will be followed:

- **Protocol A: <u>2 business days</u> notification of non-compliance of OMMP plan**
  - Discovering party notifies Camp Edwards Administrative Officer (see backup contacts below) of potential non-compliance with OMMP plan as soon as the issue is identified.
  - Camp Edwards contacts the Environmental & Readiness Center (E&RC)
  - Camp Edwards contacts USEPA and EMC in writing within 2 business days of discovering party observation of non-compliance and any corrective action that has been taken or will be taken.
  - Camp Edwards notifies CE Command Group and JFHQ COS that notification has occurred
- **Protocol B: <u>7 business days</u> submittal of any further plan to address non-compliance**
  - Sustainable Range Program will coordinate response to non-compliance within **3 business days** of the non-compliance issue being identified.
  - Camp Edwards will submit plan to address noncompliance to USEPA and EMC.

Contacts: Camp Edwards
Range Control OIC: 508-968-5925 or 5926
Camp Edwards Administrative Officer 508-968-5885 or 5883
Camp Edwards alternate contact: Plans & Training officer 508-969-5888

E & RC Deputy Director 508-968-5154, Alternate contact: 508-968-5143

Contacts: Regulators
Ms. Lynne Jennings
United States Environmental Protection Agency, Region 1
5 Post Office Square Suite 100
Boston, Massachusetts 02109-3912
Jennings.lynne@epa.gov
617-918-1218

Mr. Mark Begley
Executive Office of Energy & Environmental Affairs
Environmental & Management Commission
Building 1204, Camp Edwards, MA 02542-5003
Mark.begley@state.ma.us
508-968-5127

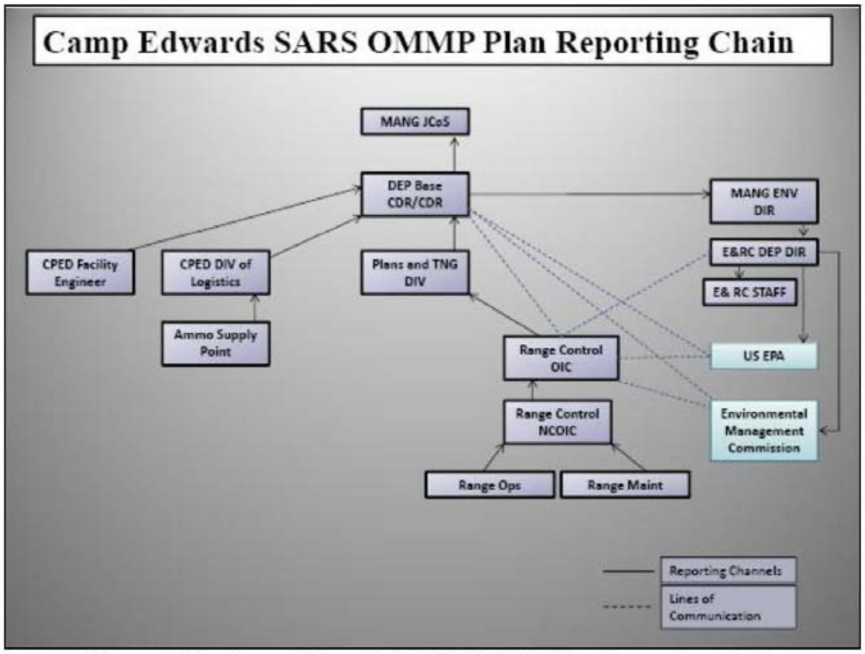

Figure 12-1. Camp Edwards SARS OMMP Plan Reporting Chain

The following table, **12-1**, summarizes various notifications to the regulatory agencies as required by this OMMP.

Table 12-1. Notification Requirements

If/ Metric	Then/ Notification Required
Any of the provisions of this OMMP can't be completed	Notify the regulatory agencies within **2 business days** of any provisions of this OMMP that can't be completed and any corrective action that has been taken or will be taken to return to compliance
STAPP™ repairs are needed but can't be complete within 5 days	Cover the STAPP™ with tarps or notify regulatory agencies of the issue within the **5 business days**
STAPP™ liner repair	Notify regulatory agencies **2 business days** in advance of repairs.
Live firing is scheduled on a range	The regulatory agencies will be notified in advance of range use through either the Range Control Weekly Range bulletin or email if range use was not posted in the bulletin.
Sampling of soil, pore water, or groundwater is scheduled	Notify regulatory agencies **2 business days** in advance of sampling.
Periodic Metals Removal: bullets will be removed after 500,000 rounds have been fired on J and T Ranges and after 750,000 rounds at K Range or as approved by EPA and EMC.	*After 400,000 rounds on J and T ranges and 650,000 rounds on K Range the MAARNG will notify EPA and the EMC, request funding, and begin the contracting process for periodic metals removal.*

STAPP™ System Metals Removal	The MAARNG will notify the EPA and the EMC of the scheduled work at least **2 business days** prior to start.

By the 10th day of every month, MAARNG will submit to the regulatory agencies a monthly report that: (1) describes the actions which have been taken toward maintaining compliance during the previous month; (2) include a summary of all results of sampling and tests and all other data received or generated by MAARNG or its contractors or agents in the previous month; (3) identify all work plans, reports, and other deliverables required by the OMMP or approvals that were completed and submitted during the previous month; (4) describe all actions scheduled for the next six weeks and provide other information relating to the progress of work under the OMMP or approvals; include information regarding percentage of completion, unresolved delays encountered or anticipated that may affect the future schedule for implementation of the work, and a description of effort made to mitigate those delays or anticipated delays.

By December 15 of each year, an annual report will be submitted to the EPA and with a copy provided to the EMC, containing all environmental data collected on J, K, and T ranges during the year. The report will summarize all exceedences and re-sampling conducted. Any issues encountered during the year will also be discussed in the annual report.

To facilitate the periodic review and continual improvement of this plan and, in turn, the management of the ranges, MAARNG will document operations, monitoring, and maintenance. **Table 12-2** identifies the records that MAARNG will maintain for the ranges. These records will be maintained indefinitely and will become part of the permanent real property records of the site.

Table 12-2. Reporting Requirements

Record	Contents	Reporting Frequency	Responsible Office
Range Utilization Report	• Summarized from the Range Utilization forms • Use days • Munitions expenditures by type, quantity, and using unit	Annually	Range Control
Environmental Data	• Soil analytical results • Groundwater analytical results • Pore water analytical results	Within **2 business days** of receipt from lab	E&RC
Environmental Sampling and Analysis Report	• Water from bullet containment systems • Groundwater • Lysimeter • Soil • Soil and porewater pH	Annually, by **December 15**	E&RC
State of the Reservation Report	As per Chapter 47 and the EPSs	Annual	E&RC
Monthly Report	• Actions taken toward compliance • Summary of all sampling data received • Summary of all work plans/deliverables • Actions scheduled for the next 6 weeks	Monthly, by the **10th** of the following month	E&RC

	• Summary of range inspections and STAPP™ water removed		

Section 10 of this OMMP describes maintenance actions that may need to occur based on inspections of the STAPP™ system. **Table 12-3** summarizes the required responses to various potential observations made during those inspections.

Table 12-3. STAPP™ Maintenance Notification Requirements Summary

If/ Metric	Then/ Response Required
Needed repairs preclude use of a part of the range	Shut down that part of the range until repairs are made.
Rubber media is visible	Cover the STAPP™ with tarps or repair as soon as possible not to exceed **5 business days**
Seem fails above the bottom 1 foot of the cover and exceeds 6 inches length	Cover the STAPP™ with tarps or repair as soon as possible not to exceed **5 business da**ys of inspection
Seem fails within the bottom 1 foot of the cover and exceeds 1 inch length	Cover the STAPP™ with tarps or repair as soon as possible not to exceed **5 business days** of inspection
A bulge or depression forms more than 4 inches deep/tall and 4 feet in length	Cover the STAPP™ with tarps or repair within **5 business days**. If repairs require a contracted specialist, cover the STAPP™ with tarps. Scheduling of contracted work will be executed as soon as funding and scheduling will allow.
Holes, rips, or seem failures occur in the bottom liner	Cover the STAPP™ with tarps or repair within **5 business days**. If repairs require a contracted specialist, cover the STAPP™ with tarps. Scheduling of contracted work will be executed as soon as funding and work scheduling will allow.
Water leaks from the reservoir	Immediately contain the leak, remove any additional water, and cover the STAPP™ with tarps or initiate repairs within **72 hours of inspection, weather permitting**
Reservoir cracks or punctures	Prevent a release of liquid from the reservoir. Cover the STAPP™ with tarps or repair with **72 hours** of inspection, weather permitting
15 cm or more of water accumulates in the reservoir	Remove water within **72 hours**, weather permitting
Impervious Cover Tarps	Maintain and keep secure, on the STAPP™ system, a tarp that will prevent water from infiltrating the system.
Toe berm Box Compromised	If a particular box shows evidence structure failure and or of projectile penetrations on the rear of the box then that lane will be shutdown from reflexive fire on Juliet and Kilo Ranges and all fire on that lane at Tango Range until the box can be repaired.

13.0 UPDATING BMPS AND THE OMMP

This OMMP should be considered a living document. Updates will be needed periodically as best management practices evolve, as the state of knowledge grows over time, and as training needs on the ranges change. This revised combined OMMP is itself a revision of earlier versions used during the pilot periods on J, K, and T ranges. The need for revision was recognized by the MAARNG and the regulatory agencies. Through the cooperation of all parties an OMMP that is easier to use and provides BMPs that are beneficial to environmental protection. Future evolution of the plan may involve significant re-writes or may be the sum of smaller incremental changes over time.

The updates should address three general questions:

- Are the BMPs functioning as intended?
- Are the assumptions used at the time of BMP selection still valid?
- Does new information indicate that the previously selected BMPs are no longer protective of the environment?

All proposed changes to this OMMP will be documented by both revising the document and providing new copies to all parties involved, or, in the case of relatively minor changes, by providing addendums as needed. When the OMMP is revised, it will be mentioned in the *Annual State of the Reservation Report.*

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Appendix A
Training Facility Utilization Report Form

CAMP EDWARDS TRAINING FACILITY UTILIZATION REPORT

(This form will be completed by all units/ organizations conducting training at Camp Edwards IAW CE Reg 385-63, AUG 2006. Return form to Range Control upon completion of training.)

UNIT:	**UIC**:	**COMPONENT**:
ADDRESS:		**DATE OF TRAINING**:
POC CONTACT NUMBERS	**DSN**:	**CELL**:
NAME/ RANK / LAST 4 RANGE OIC:	**NAME/ RANK / LAST 4 RANGE RSO**:	
NUMBER OF PERSONNEL TRAINED:	**RANGE HOT TIME**:	**RANGE COLD TIME**:
FIRING LANES USED DURING TRAINING (circle the lanes used): **1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29**		
WEAPONS SYSTEMS:	**TYPE OF AMMUNITION**:	**NUMBER EXPENDED**:
VEHICLES BY TYPE PRESENT ON RANGE:		**QTY**:
BIVOUAC AREA USED:	**NUMBER of PERSONNEL**:	**NUMBER of NIGHTS**:
TYPES OF EXERCISES CONDUCTED:		
AAR COMMENTS:		
SIGNATURE OF RANGE OIC/ RSO: **DATE**:		

GRID COORDINATES FOR THE FOLLOWING TRAINING MUST BE PROVIDED			
Activity	**TYPE**	**Location 6 digit**	**Other**
Small Arms Simulated	Blank / Simunition / Paint Ball		
RSOP (FA Dry Fire)			
Convoy Overlay	DAY / NIGHT		Number of Vehicles

CAMP EDWARDS TRAINING FACILITY UTILIZATION REPORT

(This form will be completed by all units/ organizations conducting training at Camp Edwards IAW CE Reg 385-63, AUG 2006. Return form to Range Control upon completion of training.)

Dismounted Training			
ISBC Scenario & Overlay			
Command Post Ex			
Heavy Equip Operations:			
Land Nav Course	I / II / III / Mounted		
Excavations:	STANDARD / NON-STANDARD*		
	*If NON-STANDARD has request been approved? YES / NO		ATTACH APROVAL
Describe Excavation training:			
OTHER :			

TRAINING AREA / ROAD CONDITION ASSESSMENT						
	RANGE(S) / TRAINING AREA(S) OCCUPIED					
OBSERVATION						
Minor erosion or obstruction(s)						
Movement difficulty, erosion or obstruction(s)						
Movement severely impeded, erosion or obstruction(s)						
Vegetation damaged, soil disturbed						
Bare ground and soil disturbed						
Denuded of vegetation and / or soil disturbed						
Other Training Land damage or improvement						

E = Excellent; G = Good; F= Fair; P=Poor; N=Needs improvement

Appendix B-1, B-2, B-3, B-4, and B-5
Range Control Inspection Forms

Camp Edwards Range Control
STAPP Range Inspections/Clearance Checklist (Appendix B-1)

(This form is to be completed by Camp Edwards Range Control personnel with a unit observer before and after range use.)

A.	Administrative Data	
Range (circle one)	TANGO / JULIET / KILO	Pre Fire DATE:
		Post Fire DATE:
Range Control Inspector:		
Unit Observer:		UNIT:

B.	Range Inspection				
	Pre-Fire Inspection		Post Fire Inspection		DEFICIENCIES
	SAT	UNSAT	SAT	UNSAT	Note if deficiency was found Pre or Post Firing and check box if corrective actions are needed
Parking Area/other POL use areas (POL leaks or stains)					☐
CLP use areas (spills and secondary containment)					(Ensure unit/agency is issued 5 gallon waste hazardous bucket and is returned to RC after firing event for proper disposal) ☐
Firing Line (Brass, ammo, trash, sandbags)					☐
Range floor (Brass, ammo, trash)					☐
Grass area's (Trash, cleanliness)					☐
Gravel Walkway (Trash, cleanliness)					☐
Wood Line (Trash, cleanliness)					☐
Range Tower (Trash, cleanliness, secured)					☐
Bleachers (Trash, cleanliness)					☐
*Target Frames (Good working condition, Approved?)					☐
*E-Type silhouette Targets (Approved? Returned to shed)					☐
Canvas Targets (Returned to shed/used to RC)					☐
Range Shed (clean, organized, swept)					☐

* Ensure that all targets and frames are RC approved and designed to mitigate overshot.

ANY UNSAT POST FIRE INSPECTIONS NEED TO BE RECTIFIED PRIOR TO CLEARING UNIT.

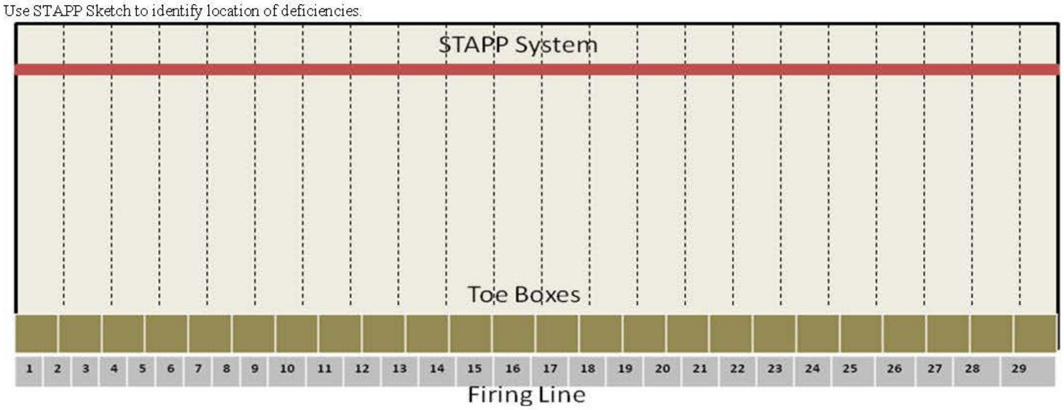
B-1

Camp Edwards Range Control
STAPP Range Inspections/Clearance Checklist (Appendix B-1)

(This form is to be completed by Camp Edwards Range Control personnel with a unit observer before and after range use.)

STAPP System Inspection					
	Pre-Fire Inspection		**Post Fire Inspection**		**DEFICIENCIES**
	YES	NO	YES	NO	Note if deficiency was found Pre or Post Firing and corrective actions needed.
Tarp Cover must be removed prior to firing!					
Are there penetration holes where the rubber media is visible?					
Are there separations on cover seams greater than five inches or rubber media visible?					
Label or identify all fresh signs of over/ undershot?					(Ensure that all previous overshot's are identified prior to firing, and all new overshot is identified post firing)
Is the lumber support frame condition compromising the integrity of the STAPP Cover and liner?					(If Yes, then firing cannot be conducted)
Does the water inspection port have more than 15cm of water?					(If Yes, notify maintenance to drain. Firing cannot be conducted until water level is below 15cm)
Are there any issues with the STAPP system that would prevent firing from being conducted?					(If Yes, note the issues)
NOTE: All UNSAT conditions must have deficiencies comment. Use N/A if not applicable. If deficiencies require maintenance then ensure copy of this inspection is giving to fire desk IOT notify maintenance of requirements.					

Use STAPP Sketch to identify location of deficiencies.



C.	**Signatures**
Range Control Inspector:	Unit Observer:

B-1

Camp Edwards Range Control
STAPP Detailed Inspection Form (Appendix B-2)

(This form is to be completed by Camp Edwards Range Control personnel monthly or after a significant storm event.)

A.	**Administrative Data**
Range (circle one) TANGO / JULIET / KILO	Date:
Range Control Inspector:	Circle one: Bi- weekly / Monthly / Rain Event

B.	**STAPP System Inspection**		
	YES	NO	**DEFICIENCIES** (Note all deficiencies and check box if corrective actions are needed)
1. Tarp Cover on and secured? - If Tarp is on then questions 2, 7, 9-11 only need to be filled out.			
2. Does the tarp cover need to be repaired?			(Ensure that there are no holes, rips or seam failures that would enable water to pass through the tarp)
3. Are there penetration holes/rips in the STAPP cover greater than 1.5 inches in length or is the rubber media visible?			
4. Are there failed seams on the STAPP cover greater than 5 inches and greater than one inch on the bottom one foot of the cover?			
5. Any bulging or irregular settling of rubber granular material that exceeds 4 inches in height/depth over a length of 4 feet?			
6. Is there ponding of water on cover?			
7. Is water leaking from the STAPP system?			
8. Is the lumber support frame in good condition?			(Ensure the integrity of the STAPP cover and liner are not compromised)
9. Has the STAPP system side of the toe berm boxes been penetrated by projectiles? Refill toe box with sand and reapir holes before next range or lane use.			(Notify RC OIC or NCOIC if projectiles have passed through the rear of the toe berm boxes)
10. Are all holes, tears, and damage to toe berm boxes repaired?			
11. Do the Toe boxes and bags fully cover/protect the base of the STAPP system?			(Ensure that all holes/rips/tears are repaired on toe berm boxes, and replaced ripped sandbags)
12. What is the depth of water in the reservoir?			If 15cm or higher, then maintenance needs to be conducted. cm

NOTE: If deficiencies require range maintenance for corrective action then ensure copy of this inspection is giving to fire desk and maintenance is notified.

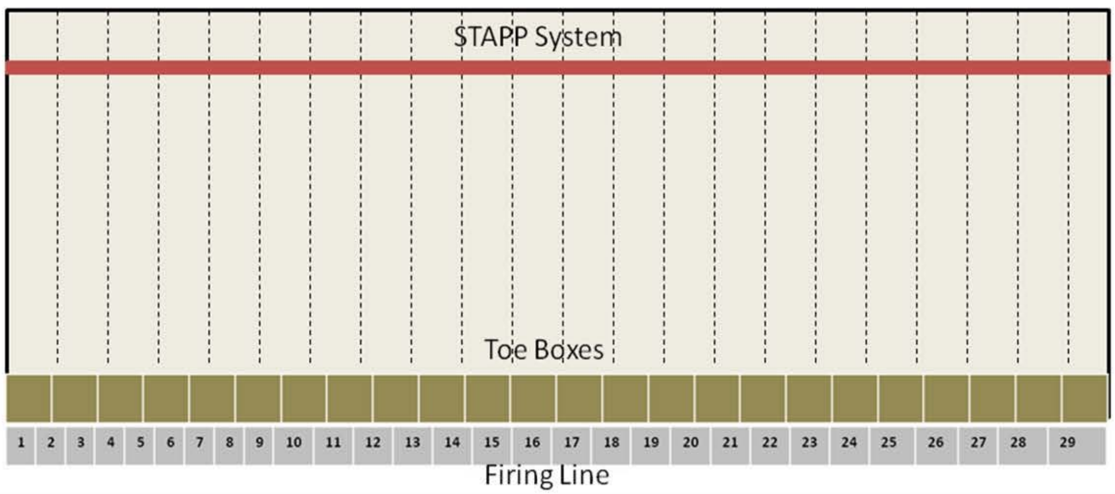
B-2

Camp Edwards Range Control
STAPP Detailed Inspection Form (Appendix B-2)

(This form is to be completed by Camp Edwards Range Control personnel monthly or after a significant storm event.)

ALL MAINTENANCE NEEDS TO BE COMPLETED WITHIN 72 HOURS OF INSPECTION!

13. Use diagram to indicate location of deficiencies noted from questions 3-8.



C.	**Erosion**			
Circle one and indicate location on range sketch below				**If moderate or severe, please describe**
1. Firing Positions	None	Moderate	Severe	
2. Berm / Backstop	None	Moderate	Severe	
3. Range Floor	None	Moderate	Severe	

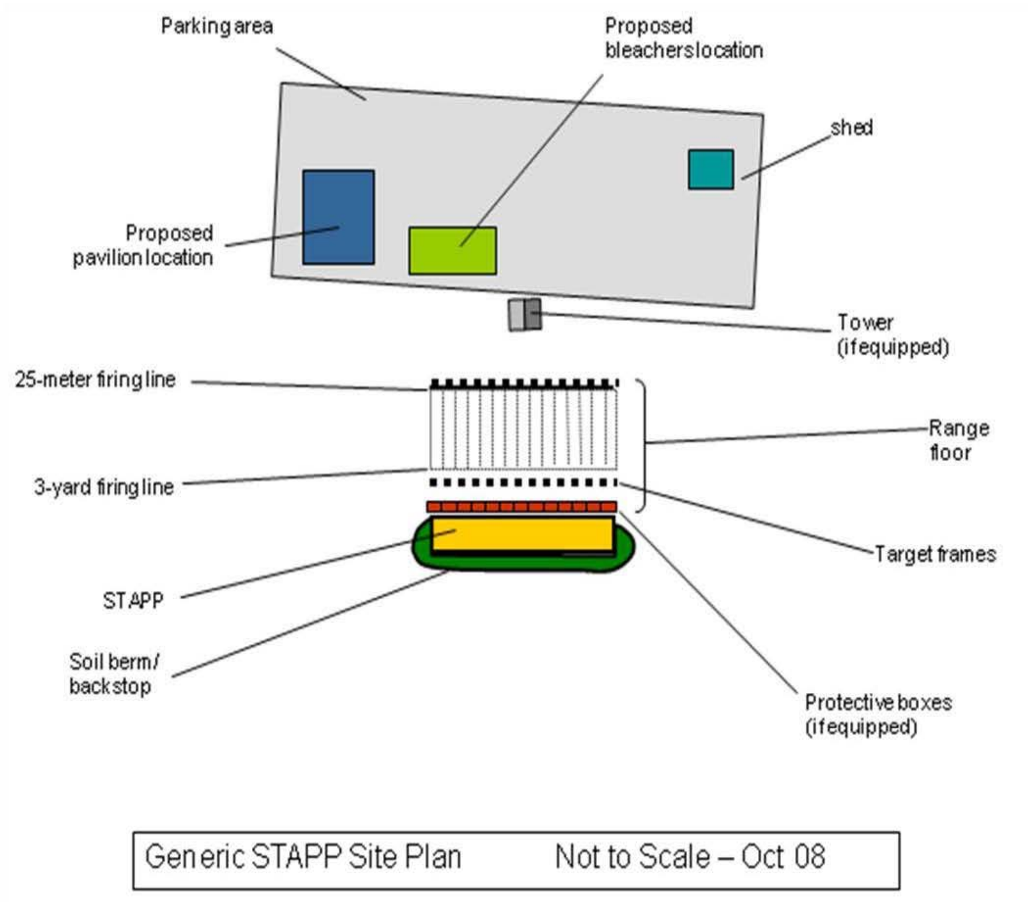
D.	**Vegetation**		
	Percent Vegetative Coverage (circle one)		
1. Soil berm/backstop	0-25 %	26-50%	51-100%
2. Range Floor	0-25 %	26-50%	51-100%

B-2

Camp Edwards Range Control
STAPP Detailed Inspection Form (Appendix B-2)
(This form is to be completed by Camp Edwards Range Control personnel monthly or after a significant storm event.)

(Update range sketch, drop "if equipped" after protective (toe berm) boxes)

E.	Range Sketch



F.	Signature
Range Control Inspector	NOTE: Ensure form is signed and placed in appropriate Range Binder.

B-2

Camp Edwards Range Control
Range Photo Log (Appendix B-3)

(This form is to be completed by Range Control personnel quarterly to show the range general conditions, erosion, vegetation and STAPP system. Once completed file in appropriate range binder for submission.)

Tango Range Photo Inspection

Photo No.	Date	
1	27 Oct 11	
Location: Firing Line		
Description West facing East Firing line is in good shape. Range Control has scheduled landscaping upgrades for November and will complete if weather allows.		

Photo No.	Date	
2	27 Oct 11	
Location: Soil Berm		
Description West side of berm, good vegetation. No signs of erosion		

B-3

Camp Edwards Range Control
Range Photo Log (Appendix B-3)

(This form is to be completed by Range Control personnel quarterly to show the range general conditions, erosion, vegetation and STAPP system. Once completed file in appropriate range binder for submission.)

Tango Range Photo Inspection (update pictures to not include plywood)

<table>
<tr><td>Photo No.

3</td><td>Date

27 Oct 11</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Location:

Bullet Containment System</td></tr>
<tr><td colspan="2">Description

West looking East

Note: Tarp placed on STAPP System for weather protection.</td></tr>
</table>

<table>
<tr><td>Photo No.

4</td><td>Date

27 Oct 11</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Location:

Bullet Containment System</td></tr>
<tr><td colspan="2">Description

East looking West

Note: Same as above</td></tr>
</table>

B-3

Camp Edwards Range Control
Range Photo Log (Appendix B-3)

(This form is to be completed by Range Control personnel quarterly to show the range general conditions, erosion, vegetation and STAPP system. Once completed file in appropriate range binder for submission.)

Tango Range Photo Inspection

Photo No.	Date
5	27 Oct 11

Location:

Range Floor

Description

No issues: End of year landscaping will be conducted starting in November if weather permits

Photo No.	Date
6	27 Oct 11

Location:

STAPP support berm

Description

Note: Good vegetation and minimal signs of erosion. This will be part of range landscaping work in November

B-3

Camp Edwards Range Control
STAPP System Internal Inspection Form – Appendix B-4

(This inspection is to be completed by Range Control personnel when the bullet sifting of the STAPP system is conducted after 500,000 rounds have been fired on Juliet and Tango Ranges and after 750,000 rounds have been fired on Kilo Range. At that time, all of the granular rubber material is removed.)

A. Administrative Information	
Name:	**Date:**
Range (circle one): Juliet / Kilo / Tango	

B. STAPP™ Internal Inspection			
1. Is the water collection unit and surrounding support structure in good condition?	YES	NO	*Look for any conditions which would allow water to be released to ground surface. If no, please describe:*
2. Any perforations of the impermeable liner?	YES	NO	*Inspect the liner for any holes, rips, punctures, or seam failures. If yes, please describe*
3. Notes regarding need for repair and maintenance:	NOTES:		

C. Signature	
Range Control Inspector	NOTE: Ensure from is signed and placed in appropriate Range Binder.

D. Examples


Figure 4-3. Examples of Perforated (Right) and Intact (Left) Liners (photos not taken at Camp Edwards)

B-4

Camp Edwards Range Control STAPP
Range Maintenance/ pH Testing / Lime Spread Form (Appendix B-5)

(This form is to be completed by Camp Edwards Range Control personnel when range maintenance is conducted and on a monthly basis or as needed for pH testing. Once completed file in appropriate range binder for submission.)

A.	**Administrative Information**	
Name:	**Start Date**	**End Date**
Range (circle one): Juliet / Kilo / Tango		

B.	**Range Maintenance**		
Location	Maintenance Conducted		Explain Maintenance conducted
1. STAPP (identify which; Cover, Seem, support frame.)	YES	NO	
2. Water Level	YES	NO	(How many gallons pumped / what is current depth)
2. Toe Berm Boxes	YES	NO	
3. Target Line	YES	NO	
4. Firing Line	YES	NO	
5. Range Floor	YES	NO	
6. Berm	YES	NO	
7. Tarp	YES	NO	
8. Maintenance Conducted that was not addressed above:			

C.	**Signature**
Range Control Personnel:	NOTE: Ensure form is signed and placed in appropriate Range Binder.

B-5

Camp Edwards Range Control STAPP
Range Maintenance/ pH Testing / Lime Spread Form (Appendix B-5)

(This form is to be completed by Camp Edwards Range Control personnel when range maintenance is conducted and on a monthly basis or as needed for pH testing. Once completed file in appropriate range binder for submission.)

A. Administrative Information	
Name:	**Date:**
Range (circle one): Juliet / Kilo / Tango	

B. PH Testing Results

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12
Firing Line												
Berm												
STAPP												

**Take a total of 6-12 samples along the entire firing line, 6-12 samples along the berm and 6-12 samples along front of STAPP System.
***Required PH Level by OMMP: 6.5 - 8.5

C Lime Spread/Type of Lime

**Lime will be applied before peak training season to increase its effectiveness/ applied as need after annual pH check.

Date	Type of Lime	How Spread/ Rate

D. Signature

Signature of Soldier Conducting PH Testing:

B-5

Appendix C

Sampling Rotation for Juliet, Kilo, and Tango Ranges
(See section 10 for sampling requirements)

RANGE	2015	2016	2017	2018	2019	2020
J Range						
Soil		x		x		x
Pore Water	x	x	x	x	x	x
Groundwater	x	x	x	x	x	x
K Range						
Soil	x		x		x	
Pore Water	x	x	x	x	x	x
Groundwater	x	x	x	x	x	x
T Range						
Soil	x		x		x	
Pore Water	x	x	x	x	x	x
Groundwater	x	x	x	x	x	x

Reference Text: Section 11.

Each range will be sampled biennial with samples collected in July/August. For example, J Range may be sampled during even numbered years and K and T ranges may be sampled during odd numbered years.

In the summer of each year (July/August), the lysimeters will be sampled.

Samples of the groundwater wells down gradient of the active portion of the ranges will be taken annually.

APPENDIX B
ANNUAL SAMPLING REPORTS
2010 THROUGH 2015

J, K, and T RANGES
SOIL, PORE WATER, AND GROUNDWATER MONITORING REPORT

Sampling through October 2010

1.0 INTRODUCTION

J, K, and T Ranges at Camp Edwards are 25-meter small arms ranges (SARs) currently used for marksmanship training using lead ammunition under a pilot test program approved by the US Environmental Protection Agency (EPA) and the Environmental Management Commission (EMC). The pilot test program is intended to test the STAPP bullet containment systems installed on these three ranges and determine if the ranges can be operated while protecting the environment. The pilot test program was recently extended at all three ranges by EPA and EMC until the end of calendar year 2011. Figure 1 shows the locations of J, K, and T Ranges within Camp Edwards.

As part of the pilot test approval, and in accordance with the conditions established by the EMC and the EPA for the Massachusetts Army National Guard (MAARNG) to fire lead ammunition, these ranges are operated and maintained as outlined in range-specific Best Management Practices and Operations, Maintenance, and Monitoring Plans (BMP/OMMP). The BMP/OMMPs include a program of periodic sampling of soil, pore water, and groundwater. The samples are analyzed for range-related analytes including select metals that are commonly used in ammunition, tungsten, and the propellant nitroglycerine. Soil samples are also collected and analyzed for pH which is an important parameter for determining the mobility of certain metals in the environment. The goal of this monitoring program is to determine when routine maintenance activities are needed to promote range sustainability and protect the environment.

This report summarizes the sampling program that was conducted by the MAARNG in 2010 as prescribed in the respective BMP/OMMPs for J, K, and T Ranges.

2.0 RANGE USE SUMMARY

J Range has been used as a SAR since the 1980s. Investigations of soil and groundwater were completed by the Impact Area Groundwater Study Program (IAGWSP) and the Final Juliet (J) Range Soil and Groundwater Investigation Report was completed in September 2008. Levels of nitroglycerine and lead that indicated deposition from range use were detected in soil. However, these analytes were not detected in groundwater. The MAARNG decided to remove surface soils from the range and regrade it in 2008 and a STAPP bullet collection system was installed. An area behind the berm on the range was excavated in

1

2010 to remove lead projectiles from the range. That soil was moved to Former D range for sifting. The range floor was completely re-graded and reconstructed to improve drainage in 2010 (see photo Figure 2). Three pan lysimeters were installed on the range in 2010 to monitor pore water percolating through the soil. The pilot test period commenced on J Range in 2009. This report summarizes the first round of operational samples collected under the BMP/OMMP. Approximately 40,600 bullets were fired into the STAPP system on the range from 2009 to 2010.

K Range has been used as a SAR since the 1980s. Investigations of soil and groundwater were completed by the IAGWSP and the Final Kilo (K) Range Soil and Groundwater Investigation Report was completed in September 2008. Levels of nitroglycerine and lead that indicated deposition from range use were detected in soil. However, these analytes were not detected in groundwater. The MAARNG regraded the range and installed a STAPP bullet collection system in 2008. An area behind the former berm on the range was excavated to remove lead projectiles from the range in 2010. That soil was moved to Former D range for sifting. The range floor was completely re-graded and reconstructed to improve drainage in 2010 (see photo Figure 2). Three pan lysimeters were installed on the range in 2010 to monitor pore water percolating through the soil. The pilot test period commenced on K Range in 2009. This report summarizes the first round of operational samples collected under the BMP/OMMP. Approximately 90,000 bullets were fired into the STAPP system on the range from 2009 to 2010.

T Range has been used as a SAR since the 1980s. Investigations of soil and groundwater were completed by the IAGWSP and the Draft Final T Range Soil and Groundwater Investigation Report was completed by the IAGWSP in June 2007. Levels of nitroglycerine and lead were detected in soil that indicated deposition from range use. However, these analytes were not detected in groundwater. The MAARNG re-graded surface soils from the mounded firing line to the 25 meter firing line (see photo Figure 3), in effect raising the 25-meter firing line and improving the angle of fire into the STAPP system. The area between the firing line and the new berm were not excavated or regraded. The STAPP bullet collection system was installed in 2006. Several suction lysimeters were installed in 2007 to monitor pore water percolating through the soil for tungsten. These were removed after sampling in 2010 because of concerns with the quality and representativeness of the samples. Three pan lysimeters were installed on the range in 2010. The pilot test period commenced in 2008. Operational samples were first under the BMP/OMMP in 2008. Approximately 254,000 bullets have been fired on the range since the commencement of the pilot test.

3.0 BMP/OMMP MONITORING REQUIREMENTS

3.1 Surface Soil

The soil sampling at J, K, and T Ranges includes multi-increment sampling (MIS) from 0 to 3 inches depth from 6 sample areas on each range (see Attachment 1, Figures 1, 2, and 3). The sample areas are laid out in strips across the width of the ranges from the firing lines to the backstop berms so that the impact of deposition at the firing lines, the target areas, and the areas in between could be separately quantified.

Soil samples were collected from all three ranges in August through September 2010. The specific sample collection protocol is described in the attached "Small Arms Range Sampling and Analysis Data Report" (Attachment 1) prepared by Tetra Tech EC, the Mass Guard's contractor who completed the sampling. Soil samples were analyzed for antimony, copper, lead, zinc, tungsten, and nitroglycerine.

Soil samples were also collected and analyzed for pH at all three ranges.

3.2 Pore Water

Pore water samples were collected from pan lysimeters installed on J, K, and T Ranges (see Attachment 1, Figures 1, 2, and 3). All pan lysimeters are installed approximately 2 feet below the ground surface. At T Range, several previously installed suction lysimeters were also sampled and then removed from the site. All pore water samples were analyzed for antimony, copper, lead, tungsten, and nitroglycerine.

3.3 Groundwater

In March 2010, the IAGWSP completed its groundwater monitoring program at J and K Ranges with a final sampling event and turned over all further sampling to the operational monitoring program conducted by the MAARNG under the BMP/OMMPs. The IAGWSP's March 2010 groundwater samples were analyzed for an extended suite of contaminants that included approximately 12 metals including antimony, copper, and lead, as well as tungsten, explosives (including nitroglycerine), and semi-volatile organic compounds (which also includes nitroglycerine). The March 2010 samples also serve the purpose of operational monitoring under the BMP/OMMPs for J and K range. In the future, all groundwater sampling at J and K Ranges will be completed by the MAARNG as specified in the BMP/OMMP. Well locations are shown on Attachment 1, Figures 1 and 2.

At T Range, well MW-467S was placed downgradient of the firing line for the MAARNG in 2006 in order to conduct operational monitoring for impacts from range use under the BMP/OMMP. MW-489S was installed by the IAGWSP in 2007 to investigate impacts of tungsten use on the former extent of T Range down range from the STAPP system. All T Range groundwater samples collected through 2008 were collected by the IAGWSP regardless of the purpose of the well. After that time, sampling was turned over to the MAARNG to be completed under the T Range BMP/OMMP. Samples were collected in March

2010 for the MAARNG (Table 1). In October 2010, the wells were sampled again by the MAARNG. March 2010 groundwater samples from T Range were analyzed for an extended list of metals, tungsten, and explosives. October 2010 groundwater samples were analyzed for a limited suite of analytes including range-related metals, tungsten, and nitroglycerine (Attachment 1) as per the BMP/OMMP. In the future, all groundwater sampling at T Range will be completed by the MAARNG as specified in the BMP/OMMP. Well locations on T Range are shown on Figure 1.

4.0 SUMMARY OF LABORATORY RESULTS

Laboratory data from the analyses of soil, pore water, and groundwater samples collected at the three ranges during this reporting period are summarized in tables included in the Small Arms Ranges Sampling and Analysis Data Report prepared by TetraTech EC which is provided as Attachment 1. Also, historical groundwater data for the range-related metals (lead, antimony, and copper) collected before October 2010 are summarized in Table 1.

5.0 COMPARISON TO BMP/OMMP ACTION LEVELS

The BMP/OMMPs for the respective ranges list interim action levels for soil, pore water, and groundwater that trigger responses at different concentrations. Action levels have been assigned for lead, antimony, and nitroglycerine in soil, pore water, and groundwater. Action levels for copper have also been assigned for pore water and groundwater (but not for soil). The action levels for soil, pore water, and groundwater are summarized on Figure 4.

Exceedence of Level 1 interim action levels trigger resampling and analysis to confirm detection. Exceedence of Level 2 interim action levels triggers focused reassessment to evaluate the cause of the elevated concentrations and assess potential hazards. Maintenance actions resulting from exceedence of Level 2 triggers may include soil removal.

There are three interim action levels for pore water. Exceedence of Level 1 action levels triggers resampling and analysis to confirm the detection. Exceedence of Level 2 action levels triggers "focused reassessment" which can include resampling and possibly range maintenance. Exceedence of Level 3 triggers range maintenance which can include soil removal and resampling.

There are three interim action levels for groundwater. Exceedence of Level 1 action levels triggers resampling and analysis to confirm the detection. Exceedence of Level 2 action levels triggers "focused reassessment" which can include resampling and possibly range maintenance. Exceedence of Level 3 can trigger a "cease fire" at the range, assessment of the pollution prevention program, and possibly remediation of the range.

As described in the BMP/OMMPs, the interim action levels are subject to change after the initial year of range operation. At all three ranges that initial year has passed, however, since the ranges continue to operate under pilot test program, the interim action levels have not yet been modified. The recent soil, pore water, and groundwater sampling results, along with recent documents related to the environmental mobility of the range contaminants, will help to determine appropriate future BMPs including action levels.

5.1 Soil

There were no exceedences of any interim action levels for soil at J Range. Figure 5 shows the sampling areas on the range and tables summarizing the detected concentrations of lead and nitroglycerine.

At K Range, the Level 1 interim action level for nitroglycerine was exceeded in one of three replicate samples collected from Area 1, however, the average concentration of the three replicates was below the Level 1 interim action level. Figure 6 shows the sampling areas on the range and tables summarizing the detected concentrations of lead and nitroglycerine.

A T Range the Level 1 interim action level for nitroglycerine in soil was exceeded at sample locations 1A, 1B, 1C, 1D, and 1E. The Level 2 interim action level was also exceeded at locations 1A, 1C, 1D, and 1E. Figure 7 shows the sampling areas on the range and tables summarizing the detected concentrations of lead and nitroglycerine.

Soil samples were also collected from all three ranges and measured for pH using a field instrument. The results are presented in Attachment 1. Average pH levels at J, K, and T Ranges were 5.65, 5.74, and 5.37 respectively. These values are all below the ideal range of 6.5 to 8.5. The application of lime can be used to raise the pH to desired levels.

5.2 Pore Water

No interim action levels were exceeded in the lysimeters at J Range.

No interim action levels were exceeded in the lysimeters at K Range.

Concentrations of antimony and copper in the suction lysimeters at T Range exceeded Level 1 interim action levels. However, those lysimeters are suspected of being prone to metals contamination and the results are therefore suspected of being not representative of actual conditions. Those lysimeters were removed from the site with the approval of the EPA and EMC shortly after sampling and replaced with three pan lysimeters. No interim action levels were exceeded in the pan lysimeters at T Range. The analytical reporting level for nitroglycerine in samples from the pan lysimeters was elevated above the concentration of the interim action levels due to analytical interferences in the samples. Future analysis of lysimeter samples for nitroglycerine should be done with a method that is more selective for nitroglycerine to eliminate the interference.

5.3 Groundwater

At J Range, barium, copper, iron, and zinc were detected at low levels commonly seen in MMR groundwater (Table 1). No tungsten, no explosives, and no SVOCs were detected. There were no exceedences of any interim action levels.

At K Range, barium and zinc were detected at low levels commonly seen in MMR groundwater (Table 1). No tungsten, no explosives, and no SVOCs were detected. There were no exceedences of any interim action levels.

At T Range, several metals were detected in the March 2010 samples from MW-467S and MW-489S (Table 1). Note that these samples were not filtered in the field as they were collected and therefore contain some sediment. The lead concentration in well MW-467S exceeded the Level 1 interim action level in March 2010. However, no lead was detected in the October 2010 sample collected from MW-467S by the MAARNG (Attachment 1). Those samples were also unfiltered. None of the analytes (lead, antimony, copper, tungsten, and nitroglycerine) were detected in MW-467S or MW-489S during the October sampling round (Attachment 1, Table 7).

6.0 COMPARISON WITH PREVIOUS SAMPLING RESULTS

6.1 Soil

The October 2010 soil sampling on J and K Ranges was the first sample collection since reconstruction of the ranges. Therefore, comparison to any previous sampling events on those ranges would not be meaningful.

At T Range, soil samples were collected by the same protocol in 2008 and 2010. The following is a brief comparison of nitroglycerine and lead concentrations as these are the two primary analytes of interest.

In 2008, only one sample area at T Range had a detectable concentration of nitroglycerine (2,700 ppb). In 2010, elevated concentrations of nitroglycerine were detected in every sample area.

Lead concentrations in sample Area 1A and Area 1B (identified as Area 1 and Area 2 in the 2008 sample results) were considerably lower in 2010 than those detected in 2008. At Area 1C (identified as Area 3 in the 2008 results), concentrations were similar and this area had the poorest correlation between replicates during both sampling events with one replicate having a considerably higher lead concentration both times. Lead concentrations in Area 1D and Area 1E (identified as Area 4 and Area 5 in 2008) were similar in the two sampling events. In Area 2A at the foot of the STAPP system (identified as Area 6 in 2008), lead concentrations increased slightly from approximately 5.5 ppm to 20 ppm (both values are averages of multiple sample replicates from the sample area). Note that 20 ppm is typical of background lead concentrations in surface soils throughout the region.

6.2 Pore Water

The October 2010 sampling of pan lysimeters on J, K, and T Ranges was the first sampling event for this new equipment. Therefore comparison to previous results is not possible. Comparison between pan and suction lysimeters would not be meaningful given that they are different technologies and placed at different locations and different depths.

6.3 Groundwater

At J Range, copper is the only range-related metal analyte detected in groundwater in 2010. It was estimated at 3.6 ppb (J flagged value). It was not detected at any concentration in previous sampling events.

At K Range, no range-related contaminants were detected in either of the groundwater wells.

At T Range, samples were collected from MW-467S and MW-489S in 2008. The samples were analyzed for copper, lead, zinc, antimony, tungsten and nitroglycerine. None of these analytes were detected in either well. This makes the one-time detection of lead and several other metals in well MW-467S during the March 2010 sampling appear to be an outlier, most likely due to sediment in the unfiltered sample. Note that lead was also not detected in the October 2010 sample from this well.

7.0 FURTHER ACTION

Samples of soil, pore water, and groundwater will be collected again in June 2011 from the three ranges as requested by EPA. The results of that sampling event will be used to determine if follow-on actions are needed at the ranges. Those results, along with the previous monitoring events, will help to determine what sampling is appropriate for future sampling events after the pilot period has ended. Several changes are recommended for the June sampling:

- It is recommended that tungsten be removed from the list of analytes for soil because tungsten has not been used on the ranges since 2006 and there are no interim action levels specified for tungsten in the BMP/OMMPs.

- It is recommended that nitroglycerine be removed from the list of analytes for soil because studies have shown that it is encapsulated within propellant fibers and is not mobile.
- If nitroglycerine is removed from the suite of analytes, as recommended in the previous bullet, there will no longer be a need to collect separate sets of ground and unground samples from each sample area. Metals and tungsten analyses can be completed with unground samples. If nitroglycerine is retained as a soil analyte, it is recommended that the metals analyses be conducted on a portion of the ground samples so that a duplicate set of unground samples need not be collected.
- The suction lysimeters that were removed from T range will be deleted from the sampling program. They have been replaced with pan lysimeters.
- It is recommended that monitoring well MW-489S on T Range be deleted because it is too far down range to monitor for potential impacts from ongoing range operation.
- All pore water and groundwater samples for metals will be filtered as they are collected in the field to remove sediment to help insure that the analyses are not impacted by sediments.
- Pore water and groundwater samples will be analyzed for nitroglycerine using a laboratory method capable of achieving reporting levels lower than the Interim Action Levels (3.2 ppb in pore water and 1.6 ppb in groundwater). Method 8332 is tentatively proposed.

A report summarizing the June 2011 sampling will be prepared and submitted by the end of August 2011.

FIGURES

Figure 1

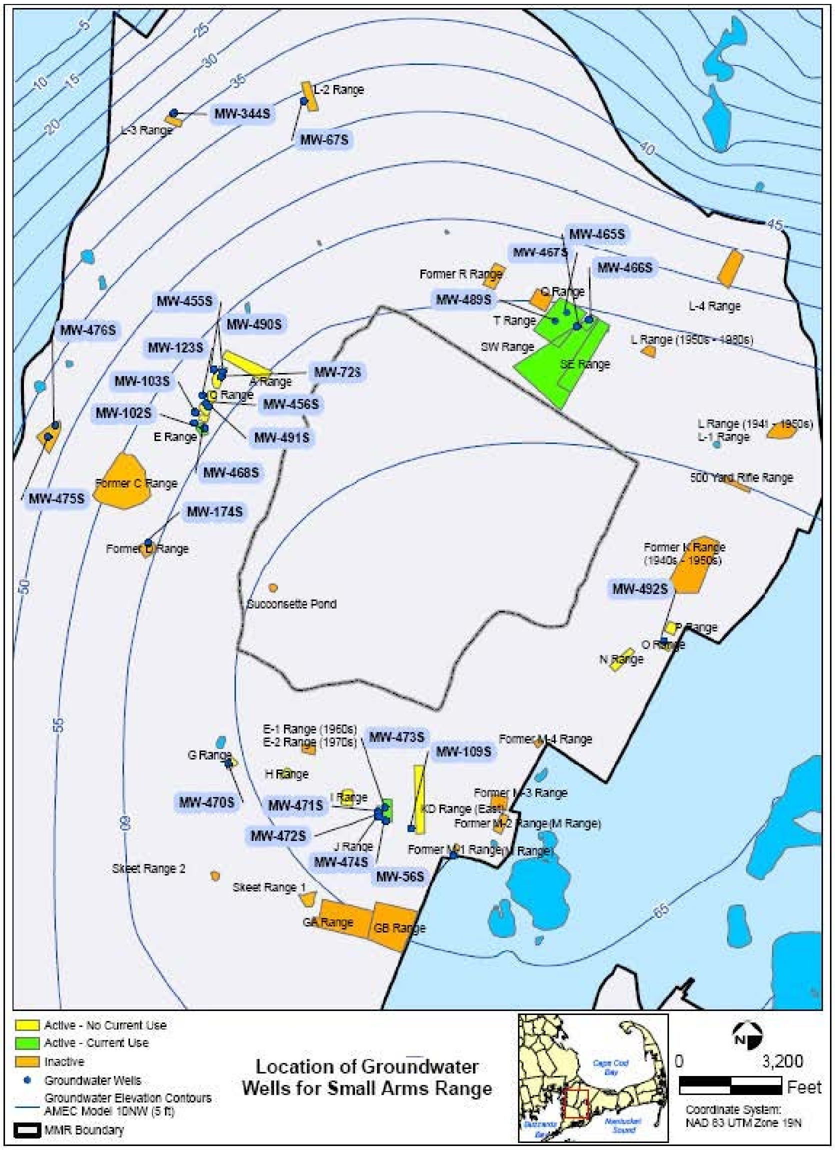

L-2 Range
MW-344S
L-3 Range
MW-67S
MW-465S
MW-467S
MW-466S
Former R Range
Q Range
MW-489S
T Range
SW Range
SE Range
L-4 Range
L Range (1950s - 1980s)
MW-455S
MW-476S
MW-490S
MW-123S
A Range
MW-72S
MW-103S
D Range
MW-456S
MW-102S
E Range
MW-491S
MW-468S
Former C Range
MW-475S
MW-174S
Former D Range
L Range (1941 - 1950s)
L-1 Range
500 Yard Rifle Range
Former K Range (1940s - 1950s)
MW-492S
P Range
O Range
N Range
Succonsette Pond
E-1 Range (1960s)
E-2 Range (1970s)
MW-473S
MW-109S
Former M-4 Range
G Range
H Range
MW-470S
MW-471S
I Range
KD Range (East)
Former M-3 Range
Former M-2 Range (M Range)
MW-472S
J Range
MW-474S
Former M-1 Range (M Range)
MW-56S
Skeet Range 2
Skeet Range 1
GA Range
GB Range
Active - No Current Use
Active - Current Use
Inactive
Groundwater Wells
Groundwater Elevation Contours AMEC Model 10NW (5 ft)
MMR Boundary
Location of Groundwater Wells for Small Arms Range
Cape Cod Bay
Buzzards Bay
Nantucket Sound
0
3,200
Feet
Coordinate System: NAD 83 UTM Zone 19N

Figure 2
J and K Ranges Under Reconstruction, 2010

11

Figure 3
T Range Re-grading, 2007

12

Figure 4
BMP/OMMP Interim Action Level Criteria

Table 4-1. Interim Surface Soil Action Levels

Analyte	Level 1 Resampling and Validation[1]	Level 2 Focused Reassessment[2]
Lead	4,535 mg/Kg	9,070 mg/Kg
Antimony	1,750 mg/Kg	3,500 mg/Kg
Nitroglycerin	5 mg/Kg	10 mg/Kg

Notes: mg/kg= milligrams per kilograms

1. Results exceeding Level 1 will be validated through resampling and analysis.
2. The purpose of the Focused Reassessment will be to evaluate the cause, and assess the hazards. Results will be reviewed with stakeholders and may result in modification of the Conceptual Site Model. If reassessment verifies sampling results, MANG will coordinate with the EMC, EPA, and MassDEP to identify appropriate maintenance actions (e.g., soil removal). Actions may include temporary suspension of the use of the range.

Table 4-2. Interim Soil-Pore Water Action Levels

Analyte	Level 1 Sampling and Validation[1]	Level 2 Focused Reassessment[2]	Level 3 Range Maintenance[3]
Lead	10 ug/L	15 ug/L	30 ug/L
Copper	867 ug/L	1,300 ug/L	2,600 ug/L
Antimony	4.0 ug/L	6.0 ug/L	12 ug/L
Nitroglycerin	3.2 ug/L	4.8 ug/L	9.6 ug/L

Notes: ug/L+micrograms per liter

1. Results exceeding Level 1 will be validated through resampling and analysis.
2. Focused Reassessment will include resampling and validation of results and an evaluation of the cause or need for action and review of the results with stakeholders. Possible modification of the Conceptual Site Model and follow-on action could result. MANG will coordinate with the EMC, EPA, and MassDEP to identify appropriate maintenance actions (e.g., dust control, pH control, soil removal).
3. Range Maintenance may include soil removal, resampling, or temporary suspension of firing on the range. The range will be reconstructed once favorable results from the post excavation sampling are received. Soil removal may not be required if a removal action has already been conducted based on soil monitoring results.

Table 4-3. Interim Groundwater Action Levels

Analyte	Level 1 Sampling and Validation[1]	Level 2 Focused Reassessment[2]	Level 3 Cease Fire and Maintenance Action[3]
Lead	5.0 ug/L	7.5 ug/L	15 ug/L
Copper	434 ug/L	650 ug/L	1,300 ug/L
Antimony	2.0 ug/L	3.0 ug/L	6.0 ug/L
Nitroglycerin	1.6 ug/L	2.4 ug/L	4.8 ug/L

Notes:

1. Results exceeding Level 1 will be validated through resampling and analysis.
2. Focused Reassessment will include resampling and validation of results and an evaluation of the cause and review of the results with stakeholders. Possible modification of the Conceptual Site Model and follow-on action could result.
3. Groundwater concentrations at or above Level 2 concentrations require significant actions including cease fire at the range, a complete reassessment of the pollution prevention program, and follow-on assessment and possible remediation.

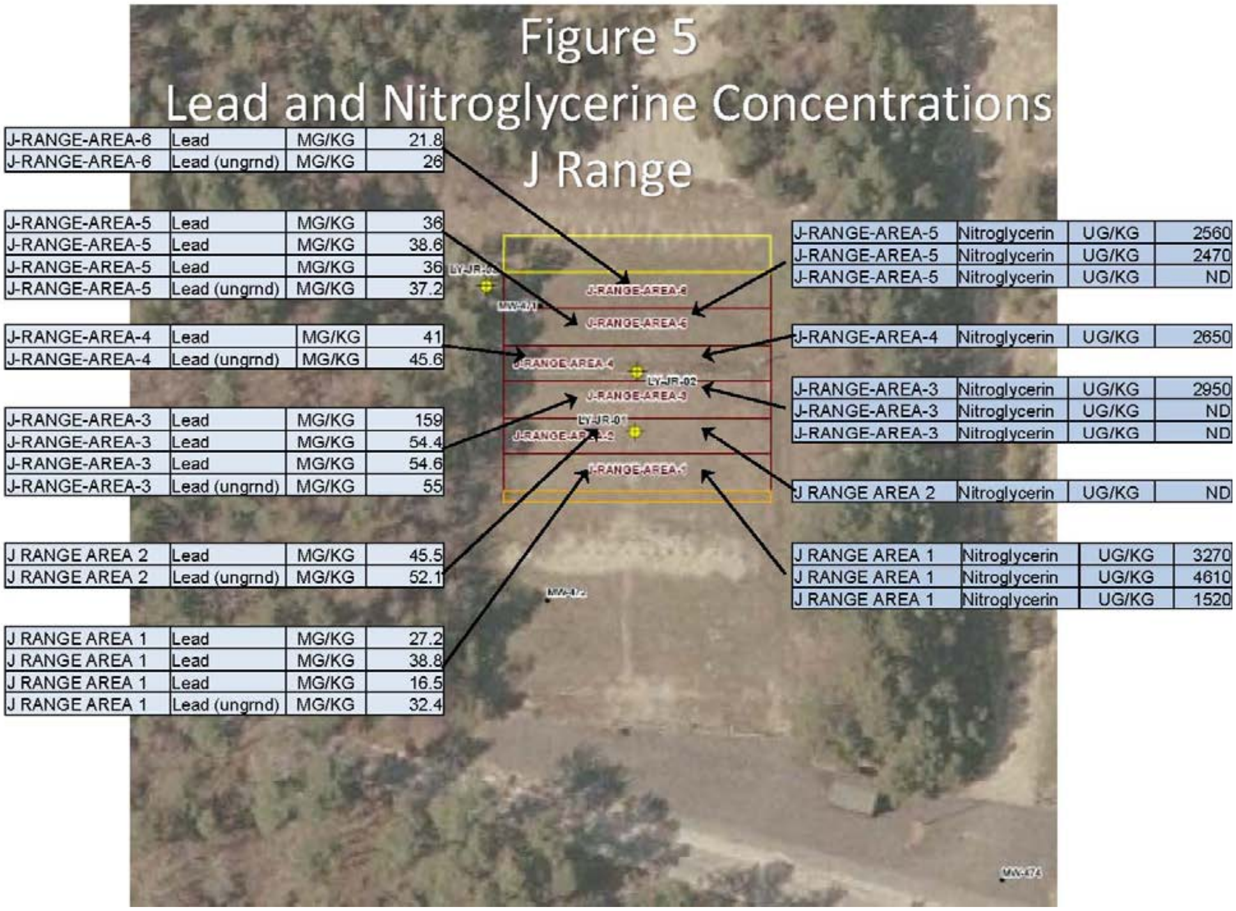


Figure 5
Lead and Nitroglycerine Concentrations
J Range
J-RANGE-AREA-6 Lead MG/KG 21.8
J-RANGE-AREA-6 Lead (ungrnd) MG/KG 26
J-RANGE-AREA-5 Lead MG/KG 36
J-RANGE-AREA-5 Lead MG/KG 38.6
J-RANGE-AREA-5 Lead MG/KG 36
J-RANGE-AREA-5 Lead (ungrnd) MG/KG 37.2
J-RANGE-AREA-4 Lead MG/KG 41
J-RANGE-AREA-4 Lead (ungrnd) MG/KG 45.6
J-RANGE-AREA-3 Lead MG/KG 159
J-RANGE-AREA-3 Lead MG/KG 54.4
J-RANGE-AREA-3 Lead MG/KG 54.6
J-RANGE-AREA-3 Lead (ungrnd) MG/KG 55
J RANGE AREA 2 Lead MG/KG 45.5
J RANGE AREA 2 Lead (ungrnd) MG/KG 52.1
J RANGE AREA 1 Lead MG/KG 27.2
J RANGE AREA 1 Lead MG/KG 38.8
J RANGE AREA 1 Lead MG/KG 16.5
J RANGE AREA 1 Lead (ungrnd) MG/KG 32.4
J-RANGE-AREA-5 Nitroglycerin UG/KG 2560
J-RANGE-AREA-5 Nitroglycerin UG/KG 2470
J-RANGE-AREA-5 Nitroglycerin UG/KG ND
J-RANGE-AREA-4 Nitroglycerin UG/KG 2650
J-RANGE-AREA-3 Nitroglycerin UG/KG 2950
J-RANGE-AREA-3 Nitroglycerin UG/KG ND
J-RANGE-AREA-3 Nitroglycerin UG/KG ND
J RANGE AREA 2 Nitroglycerin UG/KG ND
J RANGE AREA 1 Nitroglycerin UG/KG 3270
J RANGE AREA 1 Nitroglycerin UG/KG 4610
J RANGE AREA 1 Nitroglycerin UG/KG 1520
J-RANGE-AREA-6
J-RANGE-AREA-5
J-RANGE-AREA-4
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J-RANGE-AREA-1
LY-JR-02
LY-JR-01

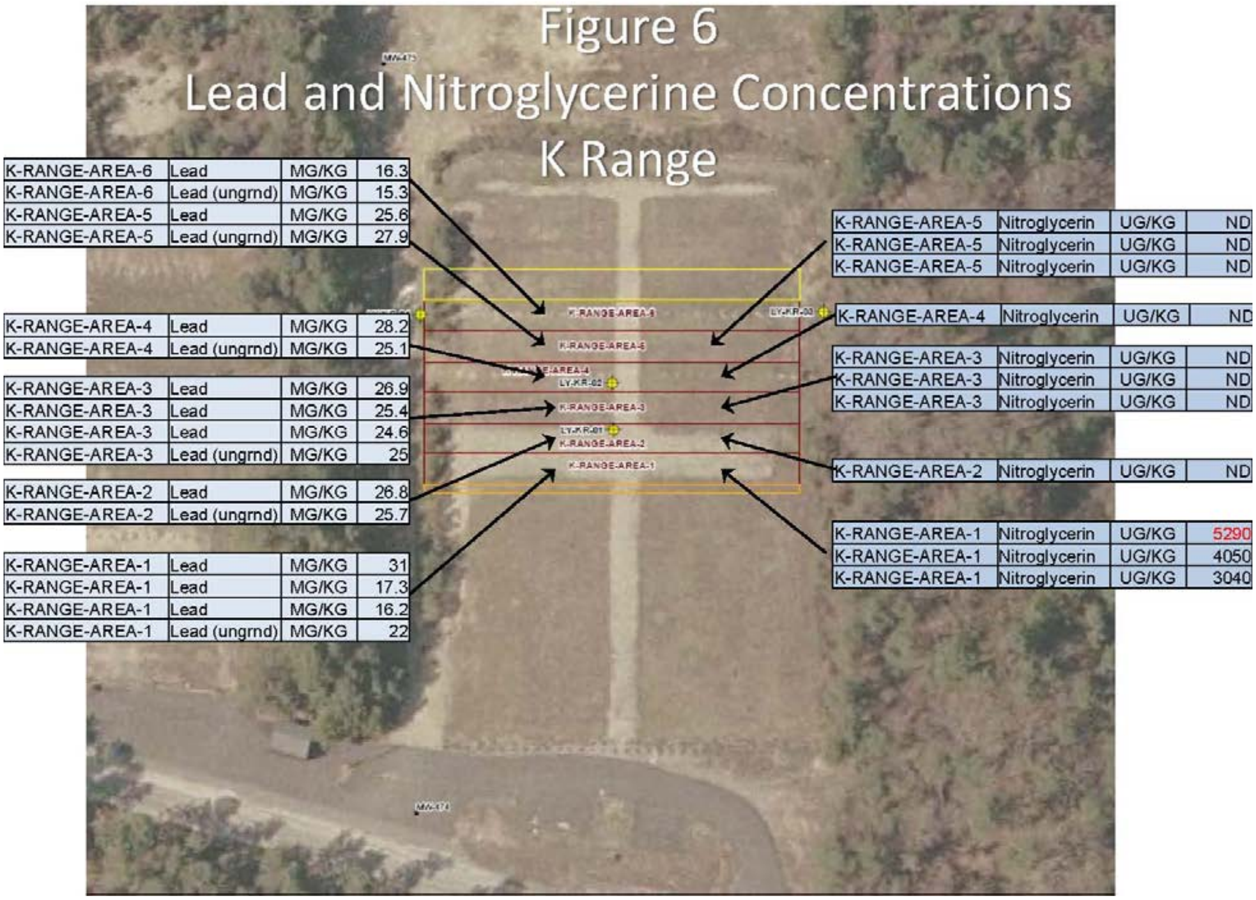
Figure 6
Lead and Nitroglycerine Concentrations
K Range
K-RANGE-AREA-6 Lead MG/KG 16.3
K-RANGE-AREA-6 Lead (ungrnd) MG/KG 15.3
K-RANGE-AREA-5 Lead MG/KG 25.6
K-RANGE-AREA-5 Lead (ungrnd) MG/KG 27.9
K-RANGE-AREA-4 Lead MG/KG 28.2
K-RANGE-AREA-4 Lead (ungrnd) MG/KG 25.1
K-RANGE-AREA-3 Lead MG/KG 26.9
K-RANGE-AREA-3 Lead MG/KG 25.4
K-RANGE-AREA-3 Lead MG/KG 24.6
K-RANGE-AREA-3 Lead (ungrnd) MG/KG 25
K-RANGE-AREA-2 Lead MG/KG 26.8
K-RANGE-AREA-2 Lead (ungrnd) MG/KG 25.7
K-RANGE-AREA-1 Lead MG/KG 31
K-RANGE-AREA-1 Lead MG/KG 17.3
K-RANGE-AREA-1 Lead MG/KG 16.2
K-RANGE-AREA-1 Lead (ungrnd) MG/KG 22
K-RANGE-AREA-5 Nitroglycerin UG/KG ND
K-RANGE-AREA-5 Nitroglycerin UG/KG ND
K-RANGE-AREA-5 Nitroglycerin UG/KG ND
K-RANGE-AREA-4 Nitroglycerin UG/KG ND
K-RANGE-AREA-3 Nitroglycerin UG/KG ND
K-RANGE-AREA-3 Nitroglycerin UG/KG ND
K-RANGE-AREA-3 Nitroglycerin UG/KG ND
K-RANGE-AREA-2 Nitroglycerin UG/KG ND
K-RANGE-AREA-1 Nitroglycerin UG/KG 5290
K-RANGE-AREA-1 Nitroglycerin UG/KG 4050
K-RANGE-AREA-1 Nitroglycerin UG/KG 3040

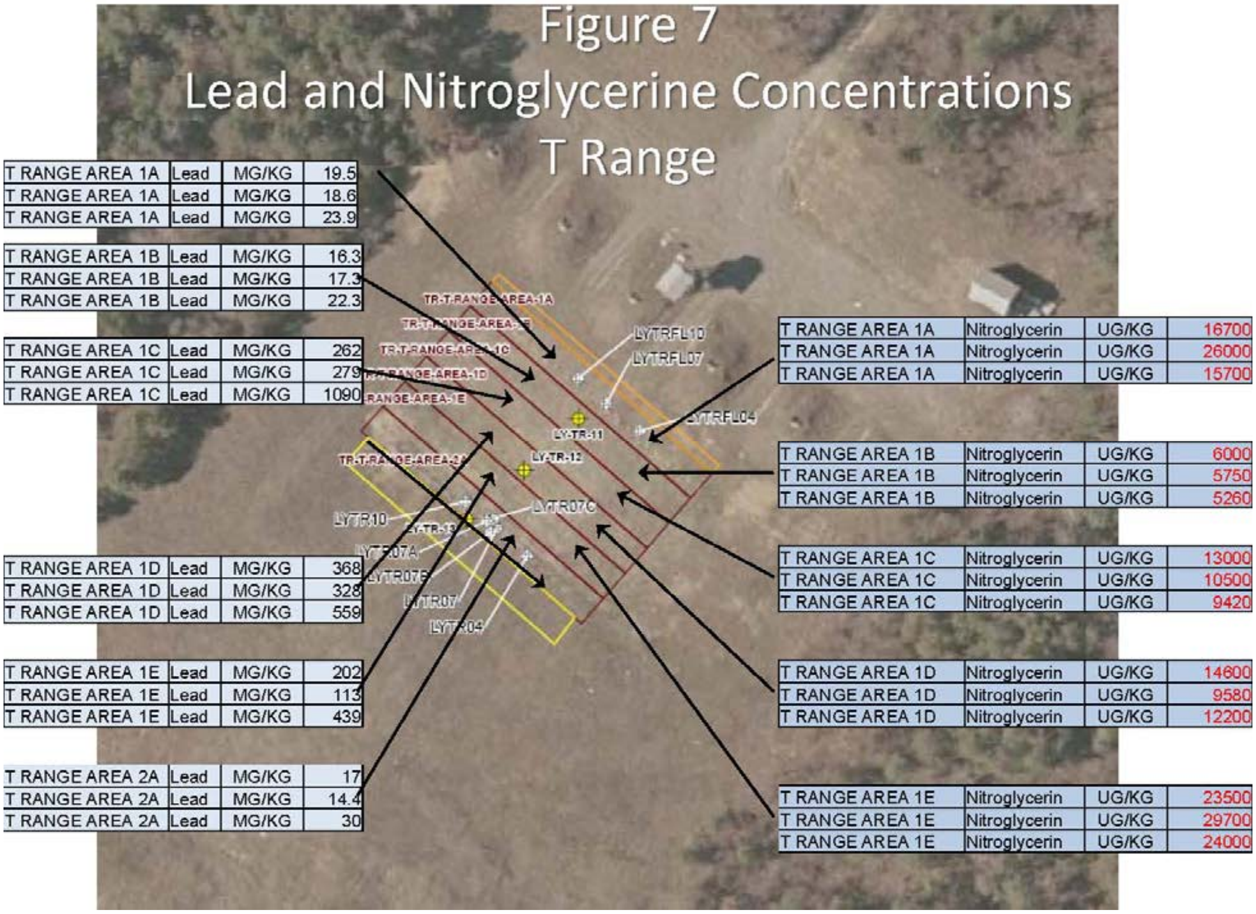

Figure 7
Lead and Nitroglycerine Concentrations
T Range

T RANGE AREA 1A	Lead	MG/KG	19.5
T RANGE AREA 1A	Lead	MG/KG	18.6
T RANGE AREA 1A	Lead	MG/KG	23.9
T RANGE AREA 1B	Lead	MG/KG	16.3
T RANGE AREA 1B	Lead	MG/KG	17.3
T RANGE AREA 1B	Lead	MG/KG	22.3
T RANGE AREA 1C	Lead	MG/KG	262
T RANGE AREA 1C	Lead	MG/KG	279
T RANGE AREA 1C	Lead	MG/KG	1090
T RANGE AREA 1D	Lead	MG/KG	368
T RANGE AREA 1D	Lead	MG/KG	328
T RANGE AREA 1D	Lead	MG/KG	559
T RANGE AREA 1E	Lead	MG/KG	202
T RANGE AREA 1E	Lead	MG/KG	113
T RANGE AREA 1E	Lead	MG/KG	439
T RANGE AREA 2A	Lead	MG/KG	17
T RANGE AREA 2A	Lead	MG/KG	14.4
T RANGE AREA 2A	Lead	MG/KG	30

T RANGE AREA 1A	Nitroglycerin	UG/KG	16700
T RANGE AREA 1A	Nitroglycerin	UG/KG	26000
T RANGE AREA 1A	Nitroglycerin	UG/KG	15700
T RANGE AREA 1B	Nitroglycerin	UG/KG	6000
T RANGE AREA 1B	Nitroglycerin	UG/KG	5750
T RANGE AREA 1B	Nitroglycerin	UG/KG	5260
T RANGE AREA 1C	Nitroglycerin	UG/KG	13000
T RANGE AREA 1C	Nitroglycerin	UG/KG	10500
T RANGE AREA 1C	Nitroglycerin	UG/KG	9420
T RANGE AREA 1D	Nitroglycerin	UG/KG	14600
T RANGE AREA 1D	Nitroglycerin	UG/KG	9580
T RANGE AREA 1D	Nitroglycerin	UG/KG	12200
T RANGE AREA 1E	Nitroglycerin	UG/KG	23500
T RANGE AREA 1E	Nitroglycerin	UG/KG	29700
T RANGE AREA 1E	Nitroglycerin	UG/KG	24000

Table 1

TABLE 1

J, K, and T Ranges Historical Concentrations of Range-Related Metals in Groundwater

Test Method	Location	Sample ID	Log Date	Northing	Easting	Screen Interval	Sample Type	Copper	Lead	Antimony
SW6010B	MW-467S(FD)	MW-467S-FD	10/09/2006	4621078.22	373709.89	124.75 - 134.75	FD	--	10.0 U	--
	MW-467S	MW-467S(TANGO)	12/03/2007	4621078.22	373709.89	0.00 - 0.00	N	0.53 J	10.0 U	--
	MW-467S	MW-467S(Tango)	07/23/2007	4621078.22	373709.89	125.00 - 135.00	N	25.0 U	10.0 U	--
	MW-467S	MW-467S-	10/09/2006	4621078.22	373709.89	124.75 - 134.75	N	--	10.0 U	--
	MW-467S	MW-467S_0310	03/16/2010	4621078.22	373709.89	124.94 - 134.94	N	2.5 J	7.1 J	60.0 U
	MW-467S	MW-467S_1008	10/09/2008	4621078.22	373709.89	125.00 - 135.00	N	25.0 U	10.0 U	--
	MW-467S	MW-467S_TR	03/27/2007	4621078.22	373709.89	125.00 - 135.00	N	25.0 U	10.0 U	60.0 U
	MW-467S	MW-467S_TR	03/27/2007	4621078.22	373709.89	125.00 - 135.00	N	25.0 U	10.0 U	60.0 U
	MW-467S	MW-467S101310A	10/13/2010	4621078.22	373709.89	0.00 - 0.00	N	25.0 U	10.0 U	60.0 U
	MW-471S	MW-471S(JULIET)	01/04/2008	4616361.28	371947.16	0.00 - 0.00	N	25.0 U	10.0 U	--
	MW-471S	MW-471S(Juliet)	07/25/2007	4616361.28	371947.16	85.00 - 95.00	N	25.0 U	10.0 U	--
	MW-471S	MW-471S-	10/30/2006	4616361.28	371947.16	84.50 - 94.50	N	--	10.0 U	--
	MW-471S	MW-471S_JR	03/29/2007	4616361.28	371947.16	85.00 - 95.00	N	25.0 U	10.0 U	60.0 U
	MW-471S	MW-471S_JR	03/29/2007	4616361.28	371947.16	85.00 - 95.00	N	25.0 U	10.0 U	60.0 U
	MW-471S	MW-471S_SPR09	03/23/2009	4616361.28	371947.16	84.60 - 94.60	N	25.0 U	--	--
	MW-471S	MW-471S_SPR10	03/22/2010	4616361.28	371947.16	84.60 - 94.60	N	3.6 J	10.0 U	60.0 U
	MW-472S(LR)	MW-472S_SPR09	03/23/2009	4616316.24	371949.95	85.30 - 95.30	LR	25.0 U	--	--
	MW-472S	MW-472S(Juliet)	07/25/2007	4616316.24	371949.95	85.00 - 95.00	N	25.0 U	10.0 U	--
	MW-472S	MW-472S(JULIET)	01/04/2008	4616316.24	371949.95	0.00 - 0.00	N	25.0 U	10.0 U	--
	MW-472S	MW-472S-	10/31/2006	4616316.24	371949.95	85.50 - 95.50	N	--	10.0 U	--
	MW-472S	MW-472S_JR	03/29/2007	4616316.24	371949.95	85.00 - 95.00	N	25.0 U	10.0 U	60.0 U
	MW-472S	MW-472S_JR	03/29/2007	4616316.24	371949.95	85.00 - 95.00	N	25.0 U	10.0 U	60.0 U
	MW-472S	MW-472S_SPR09	03/23/2009	4616316.24	371949.95	85.30 - 95.30	N	25.0 U	--	--
	MW-472S	MW-472S_SPR10	03/17/2010	4616316.24	371949.95	85.30 - 95.30	N	25.0 U	10.0 U	60.0 U
	MW-473S(FD)	MW-473S-FD	10/31/2006	4616404.03	372009.29	83.30 - 93.30	FD	--	10.0 U	--
	MW-473S	MW-473S(KILO)	01/04/2008	4616404.03	372009.29	0.00 - 0.00	N	25.0 U	10.0 U	--
	MW-473S	MW-473S(Kilo)	07/25/2007	4616404.03	372009.29	83.00 - 93.00	N	25.0 U	10.0 U	--
	MW-473S	MW-473S-	10/31/2006	4616404.03	372009.29	83.30 - 93.30	N	--	10.0 U	--
	MW-473S	MW-473S_KR	03/29/2007	4616404.03	372009.29	83.00 - 93.00	N	25.0 U	10.0 U	60.0 U
	MW-473S	MW-473S_KR	03/29/2007	4616404.03	372009.29	83.00 - 93.00	N	25.0 U	10.0 U	60.0 U
	MW-473S	MW-473S_SPR09	03/27/2009	4616404.03	372009.29	83.40 - 93.40	N	25.0 U	--	--
	MW-473S	MW-473S_SPR10	03/16/2010	4616404.03	372009.29	83.40 - 93.40	N	25.0 U	10.0 UJ	60.0 U
	MW-474S	MW-474S(Kilo)	07/25/2007	4616282.06	372018.73	86.00 - 96.00	N	25.0 U	10.0 U	--
	MW-474S	MW-474S(KILO)	01/04/2008	4616282.06	372018.73	0.00 - 0.00	N	25.0 U	10.0 U	--
	MW-474S	MW-474S-	10/31/2006	4616282.06	372018.73	86.46 - 96.46	N	--	10.0 U	--
	MW-474S	MW-474S_KR	03/29/2007	4616282.06	372018.73	86.00 - 96.00	N	25.0 U	10.0 U	60.0 U
	MW-474S	MW-474S_KR	03/29/2007	4616282.06	372018.73	86.00 - 96.00	N	25.0 U	10.0 U	60.0 U
	MW-474S	MW-474S_SPR09	03/27/2009	4616282.06	372018.73	86.40 - 96.40	N	25.0 U	--	--
	MW-474S	MW-474S_SPR10	03/15/2010	4616282.06	372018.73	86.40 - 96.40	N	25.0 U	10.0 U	60.0 U
	MW-489S(FD)	MW-489S(TANGO)	12/03/2007	4620994.24	373602.22	0.00 - 0.00	FD	0.98 J	10.0 U	--
	MW-489S	MW-489S(TANGO)	12/03/2007	4620994.24	373602.22	0.00 - 0.00	N	0.93 J	10.0 U	--
	MW-489S	MW-489S(Tango)	07/23/2007	4620994.24	373602.22	125.00 - 135.00	N	25.0 U	10.0 U	--
	MW-489S	MW-489S-	05/07/2007	4620994.24	373602.22	124.00 - 134.00	N	25.0 U	10.0 U	60.0 U
	MW-489S	MW-489S_0310	03/17/2010	4620994.24	373602.22	124.58 - 134.58	N	1.6 J	10.0 U	60.0 U
	MW-489S	MW-489S_1008	10/09/2008	4620994.24	373602.22	125.00 - 135.00	N	25.0 U	10.0 U	--
	MW-489S	MW-489S102010	10/20/2010	4620994.24	373602.22	0.00 - 0.00	N	25.0 U	10.0 U	60.0 U

Attachment 1

Draft
Small Arms Range Sampling and Analysis Data Report

Massachusetts Military Reservation
Cape Cod, Massachusetts

February 2011

Prepared for:

U.S. Army Corps of Engineers
New England District
Concord, Massachusetts
for
Massachusetts Army National Guard
Camp Edwards, Massachusetts

Prepared by:

Tetra Tech EC, Inc.
160 Federal St., Boston, MA 02110
Contract No. DACW33-03-D-0006

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FIGURES

APPENDIX

1.0 FIELD ACTIVITIES SUMMARY

Field activities were initiated on August 19, 2010 in accordance with the Small Arms Ranges (SAR) Sampling and Analysis Revised Statement of Work and agreements from the SAR Field Work Kickoff Meeting held August 18, 2010. Efforts were made to conduct field activities in accordance with the Operations, Maintenance, and Monitoring Plans from Tango Range, Juliet Range, and Kilo Range with only minor modification. Delays in collecting all of the samples were due to waiting for appreciable rainfall events in order to collect required volumes of lysimeter pore water. All analytical samples were analyzed by Test America, Inc., Burlington, Vermont. Results from the sample events are located in data tables organized by Range in Appendix A.

1.1 Juliet Range

Multi-increment soil (MIS) samples were collected from six equal-sized grids identified as JR-1 through JR-6 and shown in Figure 1. Each of these MIS samples consisted of soil from 100 grab points, at a depth of 0 to 3 inches below ground surface (bgs).

A regular MIS sample was collected from areas JR-1 through JR-5, homogenized, and divided for analysis via two separate preparation/grinding protocols. A ground sample was analyzed for lead, copper, zinc, and antimony via Method 3050b/6010b, tungsten via Method 6020, and nitroglycerin via Method 8330b. The unground sample was analyzed for lead, copper, zinc, and antimony via Method 3050b/6010b, and tungsten via Method 6020. Two additional replicate samples were collected from grids JR-1, JR-3, and JR-5, ground in a puck mill, and analyzed for lead, copper, zinc, and antimony via Method 3050b/6010b, tungsten via Method 6020, and nitroglycerin via Method 8330b.

At grid JR-6, a regular MIS sample was collected, homogenized, and divided for analysis. The laboratory ground sample was analyzed for lead, copper, zinc, and antimony via Method 3050b/6010b, and tungsten via Method 6020. The unground sample was analyzed for lead, copper, zinc, and antimony via Method 3050b/6010b, and tungsten via Method 6020. Nitroglycerin was not analyzed for grid JR-6 samples.

Three new pan lysimeters (LYJR01, LYJR02 and LYJR03) were installed on September 21 and 24, 2010, and pore water was sampled on October 8 and 18, 2010, following appreciable rain events and analyzed for lead, copper, and antimony via Method 3050b/6010b, tungsten via Method 6020, and nitroglycerin via Method 8330b. A duplicate sample was collected from lysimeter LYJR01. These lysimeters were installed at pre-positioned locations on the range floor at a pan depth of 2 feet below grade. Figure 1 shows locations of the new pan lysimeters.

Composite soil volumes were collected and screened for pH values using a Spectrum pH SoilStik. Composite soil volumes were taken from nine nodes each in front of the firing line at 0 to 1 inch bgs and at 5 to 6 inches bgs; and from nine nodes each at the toe of the STAPP berm from 0 to 1 inch bgs and from 5 to 6 inches bgs. Readings of pH from composites at these depths and locations were as follows:

Firing Line from 0 to 1 inch bgs: 5.76
Firing Line from 5 to 6 inches bgs: 6.07
Toe of STAPP berm from 0 to 1 inch bgs: 5.46
Toe of STAPP berm from 5 to 6 inches bgs: 5.31

1.2 Kilo Range

MIS samples were collected from six equal-sized grids identified as KR-1 through KR-6 and shown in Figure 2. These MIS samples consisted of soil from 100 grab points, at a depth of 0 to 3 inches bgs.

A regular MIS sample was collected from areas KR-1 through KR-5, homogenized, and divided for analysis. The laboratory ground sample was analyzed for lead, copper, zinc, and antimony via Method 3050b/6010b, tungsten via Method 6020, and nitroglycerin via Method 8330b. The unground sample was analyzed for lead, copper, zinc, and antimony via Method 3050b/6010b, and tungsten via Method 6020. Two additional replicate samples were collected from grids KR-1, KR-3, and KR-5 each, ground in a puck mill, and analyzed for lead, copper, zinc, and antimony via Method 3050b/6010b, tungsten via Method 6020, and nitroglycerin via Method 8330b.

At grid KR-6, a regular MIS sample was collected, homogenized, and divided for analysis via two separate preparation/grinding protocols. The laboratory ground sample was analyzed for lead, copper, zinc, and antimony via Method 3050b/6010b, and tungsten via Method 6020. The unground sample was analyzed for lead, copper, zinc, and antimony via Method 3050b/6010b, and tungsten via Method 6020. Nitroglycerin was not analyzed for grid KR-6 samples.

Four new pan lysimeters (LYKR01, LYKR02, LYKR03, and LYKR04) were installed on September 24 and 28, 2010. These new lysimeters were sampled on October 8 and 18, 2010, and analyzed for lead, copper, and antimony via Method 3050b/6010b, tungsten via Method 6020, and nitroglycerin via Method 8330b. These lysimeters were installed at pre-positioned locations on the range floor at a pan depth of 2 feet below grade. Figure 2 shows locations of the new pan lysimeters.

Composite soil volumes were collected and screened for pH values using a Spectrum pH SoilStik. Composite soil volume was taken from nine nodes each in front of the firing line at 0 to 1 inch bgs and at 5 to 6 inches bgs; and from nine nodes each at the toe of the STAPP berm from 0 to 1 inch bgs and from 5 to 6 inches bgs. Readings of pH from composites at these depths and locations were as follows:

Firing Line from 0 to 1 inch bgs: 5.05
Firing Line from 5 to 6 inches bgs: 4.91
Toe of STAPP berm from 0 to 1 inch bgs: 6.42
Toe of STAPP berm from 5 to 6 inches bgs: 6.58

1.3 Tango Range

Tango Range field activities commenced with the collection of samples from nine existing tension lysimeters located on the range. Lysimeters were initially purged of any stagnant water and vacuums were set for optimal water yield. Pore water from each lysimeter was accumulated and maintained from purge events on August 24 and 26, 2010, until sufficient volume was obtained for analysis. Pore water from each lysimeter was analyzed for lead, copper, and antimony via Method 3050b/6010b, tungsten via Method 6020, and nitroglycerin via Method 8330b. Existing lysimeter names and depths were as follows:

LYTRFL10 at 4 feet bgs
LYTRFL07 at 4 feet bgs
LYTRFL04 at 4 feet bgs
LYTR04 at 5 feet bgs
LYTR07 at 5 feet bgs
LYTR07A at 5 feet bgs
LYTR07B at 3.5 feet bgs
LYTR07C at 8 feet bgs
LYTR10 at 5 feet bgs

These nine lysimeters were abandoned following this sample event. Abandonment consisted of removal of PVC risers and permeable membrane at depth. Boreholes were backfilled as necessary with clean drill cuttings.

Three new pan lysimeters (LYTR11, LYTR12 and LYTR13) were installed on September 23 and 27, 2010. These new lysimeters were sampled on October 8 and 18, 2010, and analyzed for lead, copper, and antimony via Method 3050b/6010b, tungsten via Method 6020, and nitroglycerin via Method 8330b. These lysimeters were installed at pre-positioned locations on the range floor at a pan depth of 2 feet below grade. Figure 3 shows locations of the new pan lysimeters and the abandoned tension lysimeters.

MIS samples were collected from five equal-sized grids identified as TR-1A through TR-1E and shown in Figure 3. Each of these MIS samples consisted of soil from 100 grab points. All samples were collected from a depth of 0 to 3 inches bgs each. A sixth MIS sample was collected from Area 2 (grid TR-2A) between the target line and STAPP berm. This sixth sample was collected in the same manner as the previous five samples.

A regular MIS sample was collected from areas TR-1A, TR-1B, TR-1C, TR-1D, and TR-1E, homogenized, and divided for analysis with separate grinding protocol. The laboratory ground sample was analyzed for lead, copper, zinc, and antimony via Method 3050b/6010b, tungsten via Method 6020, and nitroglycerin via Method 8330b. The unground sample was analyzed for lead, copper, zinc, and antimony via Method 3050b/6010b, and tungsten via Method 6020. Two additional replicate samples were collected from each of these grids, ground in a puck mill, and analyzed for lead, copper, zinc, and antimony via Method 3050b/6010b, tungsten via Method 6020, and nitroglycerin via Method 8330b.

At Area 2, a regular MIS sample was collected from grid TR-2A, consisting of 100 grab points, at 0 to 3 inches bgs. This sample was homogenized and divided for analysis with separate grinding protocol. The laboratory ground sample was analyzed for lead, copper, zinc, and antimony via Method 3050b/6010b, and tungsten via Method 6020. The unground sample was analyzed for lead, copper, zinc, and antimony via Method 3050b/6010b, and tungsten via Method 6020. No replicates were collected from Area 2.

Groundwater samples were collected from wells MW-467S (located in the T Range parking lot) and MW-489S (located southwest of the STAPP berm). Samples were collected with a dedicated bladder pump in accordance with EPA Region 1 Low-Flow procedures and analyzed for lead, copper, zinc, and antimony via Method 3050b/6010b, tungsten via Method 6020, and nitroglycerin via Method 8330b.

Composite soil volumes were collected and screened for pH values using a Spectrum pH SoilStik. A composite soil volume was taken from nine nodes each in front of the firing line at 0 to 1 inch bgs and at 5 to 6 inches bgs; and from nine nodes each at the toe of the STAPP berm from 0 to 1 inch bgs and from 5 to 6 inches bgs. Readings of pH from composites at these depths and locations were as follows:

Firing Line from 0 to 1 inch bgs: 5.54
Firing Line from 5 to 6 inches bgs: 5.71
Toe of STAPP berm from 0 to 1 inch bgs: 5.28
Toe of STAPP berm from 5 to 6 inches bgs: 4.93

FIGURES


LY-JR-03
J-RANGE-AREA-6
J-RANGE-AREA-5
J-RANGE-AREA-4
LY-JR-02
J-RANGE-AREA-3
LY-JR-01
J-RANGE-AREA-2
J-RANGE-AREA-1
LEGEND
Lysimeter
Monitoring Well
Sampling Grid
STAPP System
Firing Line
LOCATION MAP
NOTES AND SOURCES
Map Coordinates: NAD83 UTM Zone 19N, Meters
Aerial Photos: 1:2400 color digital orthophotos
Resolution: 0.3 meter, Date Flown 2002
Source: EarthData International of Maryland
TITLE
J Range
MIS Sampling Grids
0
60
Feet
N
FIGURE
1


LY-KR-04
K-RANGE-AREA-6
LY-KR-03
K-RANGE-AREA-5
K-RANGE-AREA-4
LY-KR-02
K-RANGE-AREA-3
LY-KR-01
K-RANGE-AREA-2
K-RANGE-AREA-1
LEGEND
Lysimeter
Monitoring Well
Sampling Grid
STAPP System
Firing Line
LOCATION MAP
NOTES AND SOURCES
Map Coordinates: NAD83 UTM Zone 19N, Meters
Aerial Photos: 1:2400 color digital orthophotos
Resolution: 0.3 meter, Date Flown 2002
Source: EarthData International of Maryland
TITLE
K Range
MIS Sampling Grids
0
60
Feet
N
FIGURE
2


TR-T-RANGE-AREA-1A
TR-T-RANGE-AREA-1B
TR-T-RANGE-AREA-1C
TR-T-RANGE-AREA-1D
TR-T-RANGE-AREA-1E
TR-T-RANGE-AREA-2A
LYTRFL10
LYTRFL07
LYTRFL04
LY-TR-11
LY-TR-12
LY-TR-13
LYTR10
LYTR07C
LYTR07A
LYTR07B
LYTR07
LYTR04
LEGEND
Lysimeter
Lysimeter
Sampling Grid
STAPP System
Firing Line
LOCATION MAP
NOTES AND SOURCES
Map Coordinates: NAD83 UTM Zone 19N, Meters
Aerial Photos: 1:2400 color digital orthophotos
Resolution: 0.3 meter, Date Flown 2002
Source: EarthData International of Maryland
TITLE
T Range
MIS Sampling Grids
0
140
N
FIGURE
3

APPENDIX A
Data Tables

Table 1
J Range Validated Soil Data

AFIID	Location Description	LOC_ID	Sample ID	Sample Date	Analysis	Analyte	Units	MDL[1]	RL[2]	Result	Qualifiers[3]
MMR	J RANGE AREA 1	SSJRNG001	JR10003GA	9/2/2010	SW6010B	Antimony	MG/KG	0.16	3	0.55	J
MMR	J RANGE AREA 1	SSJRNG001	JR10003GA	9/2/2010	SW6010B	Copper	MG/KG	0.1	1.2	13.4	
MMR	J RANGE AREA 1	SSJRNG001	JR10003GA	9/2/2010	SW6010B	Lead	MG/KG	0.17	0.49	27.2	
MMR	J RANGE AREA 1	SSJRNG001	JR10003GA	9/2/2010	SW6010B	Zinc	MG/KG	0.046	0.99	32.8	
MMR	J RANGE AREA 1	SSJRNG001	JR10003GA	9/2/2010	SW6020	Tungsten	MG/KG	0.011	0.099	ND	UJ
MMR	J RANGE AREA 1	SSJRNG001	JR10003GA	9/2/2010	SW8330	Nitroglycerin	UG/KG	543	1980	3270	
MMR	J RANGE AREA 1	SSJRNG001	JR10003GB	9/2/2010	SW6010B	Antimony	MG/KG	0.16	3	0.16	J
MMR	J RANGE AREA 1	SSJRNG001	JR10003GB	9/2/2010	SW6010B	Copper	MG/KG	0.1	1.2	12.2	
MMR	J RANGE AREA 1	SSJRNG001	JR10003GB	9/2/2010	SW6010B	Lead	MG/KG	0.17	0.5	38.8	
MMR	J RANGE AREA 1	SSJRNG001	JR10003GB	9/2/2010	SW6010B	Zinc	MG/KG	0.047	0.99	31.4	
MMR	J RANGE AREA 1	SSJRNG001	JR10003GB	9/2/2010	SW6020	Tungsten	MG/KG	0.011	0.099	0.32	
MMR	J RANGE AREA 1	SSJRNG001	JR10003GB	9/2/2010	SW8330	Nitroglycerin	UG/KG	549	2000	4610	
MMR	J RANGE AREA 1	SSJRNG001	JR10003GC	9/2/2010	SW6010B	Antimony	MG/KG	0.16	3	0.48	J
MMR	J RANGE AREA 1	SSJRNG001	JR10003GC	9/2/2010	SW6010B	Copper	MG/KG	0.1	1.2	15.1	
MMR	J RANGE AREA 1	SSJRNG001	JR10003GC	9/2/2010	SW6010B	Lead	MG/KG	0.18	0.5	16.5	
MMR	J RANGE AREA 1	SSJRNG001	JR10003GC	9/2/2010	SW6010B	Zinc	MG/KG	0.047	1	35.4	
MMR	J RANGE AREA 1	SSJRNG001	JR10003GC	9/2/2010	SW6020	Tungsten	MG/KG	0.012	0.1	0.13	
MMR	J RANGE AREA 1	SSJRNG001	JR10003GC	9/2/2010	SW8330	Nitroglycerin	UG/KG	548	1990	1520	J
MMR	J RANGE AREA 1	SSJRNG001	JR10003UA	9/2/2010	SW6010B	Antimony	MG/KG	0.16	2.9	ND	U
MMR	J RANGE AREA 1	SSJRNG001	JR10003UA	9/2/2010	SW6010B	Copper	MG/KG	0.1	1.2	8.1	
MMR	J RANGE AREA 1	SSJRNG001	JR10003UA	9/2/2010	SW6010B	Lead	MG/KG	0.17	0.49	32.4	
MMR	J RANGE AREA 1	SSJRNG001	JR10003UA	9/2/2010	SW6010B	Zinc	MG/KG	0.046	0.98	27.8	
MMR	J RANGE AREA 1	SSJRNG001	JR10003UA	9/2/2010	SW6020	Tungsten	MG/KG	0.011	0.098	ND	U
MMR	J RANGE AREA 2	SSJRNG002	JR20003GA	9/2/2010	SW6010B	Antimony	MG/KG	0.16	3	0.54	J
MMR	J RANGE AREA 2	SSJRNG002	JR20003GA	9/2/2010	SW6010B	Copper	MG/KG	0.1	1.2	7	
MMR	J RANGE AREA 2	SSJRNG002	JR20003GA	9/2/2010	SW6010B	Lead	MG/KG	0.17	0.5	45.5	
MMR	J RANGE AREA 2	SSJRNG002	JR20003GA	9/2/2010	SW6010B	Zinc	MG/KG	0.047	0.99	24.3	
MMR	J RANGE AREA 2	SSJRNG002	JR20003GA	9/2/2010	SW6020	Tungsten	MG/KG	0.011	0.099	ND	U
MMR	J RANGE AREA 2	SSJRNG002	JR20003GA	9/2/2010	SW8330	Nitroglycerin	UG/KG	540	1960	ND	UJ
MMR	J RANGE AREA 2	SSJRNG002	JR20003UA	9/2/2010	SW6010B	Antimony	MG/KG	0.16	3	0.33	J
MMR	J RANGE AREA 2	SSJRNG002	JR20003UA	9/2/2010	SW6010B	Copper	MG/KG	0.1	1.2	6.8	

Table 1
J Range Validated Soil Data

AFIID	Location Description	LOC_ID	Sample ID	Sample Date	Analysis	Analyte	Units	MDL[1]	RL[2]	Result	Qualifiers[3]
MMR	J RANGE AREA 2	SSJRNG002	JR20003UA	9/2/2010	SW6010B	Lead	MG/KG	0.17	0.5	52.1	
MMR	J RANGE AREA 2	SSJRNG002	JR20003UA	9/2/2010	SW6010B	Zinc	MG/KG	0.047	0.99	28.3	
MMR	J RANGE AREA 2	SSJRNG002	JR20003UA	9/2/2010	SW6020	Tungsten	MG/KG	0.011	0.099	0.1	
MMR	J-RANGE-AREA-3	SSJRNG003	JR30003GA	9/13/2010	SW6010B	Antimony	MG/KG	0.16	3	1.1	J
MMR	J-RANGE-AREA-3	SSJRNG003	JR30003GA	9/13/2010	SW6010B	Copper	MG/KG	0.1	1.2	6.3	
MMR	J-RANGE-AREA-3	SSJRNG003	JR30003GA	9/13/2010	SW6010B	Lead	MG/KG	0.17	0.5	159	
MMR	J-RANGE-AREA-3	SSJRNG003	JR30003GA	9/13/2010	SW6010B	Zinc	MG/KG	0.047	1	21.4	
MMR	J-RANGE-AREA-3	SSJRNG003	JR30003GA	9/13/2010	SW6020	Tungsten	MG/KG	0.011	0.1	ND	U
MMR	J-RANGE-AREA-3	SSJRNG003	JR30003GA	9/13/2010	SW8330	Nitroglycerin	UG/KG	553	2010	2950	
MMR	J-RANGE-AREA-3	SSJRNG003	JR30003GB	9/13/2010	SW6010B	Antimony	MG/KG	0.17	3	ND	U
MMR	J-RANGE-AREA-3	SSJRNG003	JR30003GB	9/13/2010	SW6010B	Copper	MG/KG	0.11	1.3	11.3	
MMR	J-RANGE-AREA-3	SSJRNG003	JR30003GB	9/13/2010	SW6010B	Lead	MG/KG	0.18	0.51	54.4	
MMR	J-RANGE-AREA-3	SSJRNG003	JR30003GB	9/13/2010	SW6010B	Zinc	MG/KG	0.047	1	23	
MMR	J-RANGE-AREA-3	SSJRNG003	JR30003GB	9/13/2010	SW6020	Tungsten	MG/KG	0.012	0.1	ND	U
MMR	J-RANGE-AREA-3	SSJRNG003	JR30003GB	9/13/2010	SW8330	Nitroglycerin	UG/KG	558	2030	ND	UJ
MMR	J-RANGE-AREA-3	SSJRNG003	JR30003GC	9/13/2010	SW6010B	Antimony	MG/KG	0.16	3	0.16	J
MMR	J-RANGE-AREA-3	SSJRNG003	JR30003GC	9/13/2010	SW6010B	Copper	MG/KG	0.1	1.2	7.5	
MMR	J-RANGE-AREA-3	SSJRNG003	JR30003GC	9/13/2010	SW6010B	Lead	MG/KG	0.17	0.5	54.6	
MMR	J-RANGE-AREA-3	SSJRNG003	JR30003GC	9/13/2010	SW6010B	Zinc	MG/KG	0.047	0.99	21.5	
MMR	J-RANGE-AREA-3	SSJRNG003	JR30003GC	9/13/2010	SW6020	Tungsten	MG/KG	0.011	0.099	0.17	
MMR	J-RANGE-AREA-3	SSJRNG003	JR30003GC	9/13/2010	SW8330	Nitroglycerin	UG/KG	550	2000	ND	U
MMR	J-RANGE-AREA-3	SSJRNG003	JR30003UA	9/13/2010	SW6010B	Antimony	MG/KG	0.16	3	ND	U
MMR	J-RANGE-AREA-3	SSJRNG003	JR30003UA	9/13/2010	SW6010B	Copper	MG/KG	0.1	1.2	6.7	
MMR	J-RANGE-AREA-3	SSJRNG003	JR30003UA	9/13/2010	SW6010B	Lead	MG/KG	0.17	0.5	55	
MMR	J-RANGE-AREA-3	SSJRNG003	JR30003UA	9/13/2010	SW6010B	Zinc	MG/KG	0.047	1	25.6	
MMR	J-RANGE-AREA-3	SSJRNG003	JR30003UA	9/13/2010	SW6020	Tungsten	MG/KG	0.023	0.2	ND	U
MMR	J-RANGE-AREA-4	SSJRNG004	JR40003GA	9/13/2010	SW6010B	Antimony	MG/KG	0.16	3	ND	U
MMR	J-RANGE-AREA-4	SSJRNG004	JR40003GA	9/13/2010	SW6010B	Copper	MG/KG	0.1	1.2	7.3	
MMR	J-RANGE-AREA-4	SSJRNG004	JR40003GA	9/13/2010	SW6010B	Lead	MG/KG	0.17	0.5	41	
MMR	J-RANGE-AREA-4	SSJRNG004	JR40003GA	9/13/2010	SW6010B	Zinc	MG/KG	0.047	1	23.4	
MMR	J-RANGE-AREA-4	SSJRNG004	JR40003GA	9/13/2010	SW6020	Tungsten	MG/KG	0.023	0.2	ND	U

Table 1
J Range Validated Soil Data

AFIID	Location Description	LOC_ID	Sample ID	Sample Date	Analysis	Analyte	Units	MDL[1]	RL[2]	Result	Qualifiers[3]
MMR	J-RANGE-AREA-4	SSJRNG004	JR40003GA	9/13/2010	SW8330	Nitroglycerin	UG/KG	536	1950	2650	J
MMR	J-RANGE-AREA-4	SSJRNG004	JR40003UA	9/13/2010	SW6010B	Antimony	MG/KG	0.16	3	ND	U
MMR	J-RANGE-AREA-4	SSJRNG004	JR40003UA	9/13/2010	SW6010B	Copper	MG/KG	0.1	1.2	8.4	
MMR	J-RANGE-AREA-4	SSJRNG004	JR40003UA	9/13/2010	SW6010B	Lead	MG/KG	0.17	0.5	45.6	
MMR	J-RANGE-AREA-4	SSJRNG004	JR40003UA	9/13/2010	SW6010B	Zinc	MG/KG	0.047	1	24.6	
MMR	J-RANGE-AREA-4	SSJRNG004	JR40003UA	9/13/2010	SW6020	Tungsten	MG/KG	0.023	0.2	ND	U
MMR	J-RANGE-AREA-5	SSJRNG005	JR50003GA	9/13/2010	SW6010B	Antimony	MG/KG	0.16	3	ND	U
MMR	J-RANGE-AREA-5	SSJRNG005	JR50003GA	9/13/2010	SW6010B	Copper	MG/KG	0.1	1.2	5.1	
MMR	J-RANGE-AREA-5	SSJRNG005	JR50003GA	9/13/2010	SW6010B	Lead	MG/KG	0.18	0.5	36	
MMR	J-RANGE-AREA-5	SSJRNG005	JR50003GA	9/13/2010	SW6010B	Zinc	MG/KG	0.047	1	22.4	
MMR	J-RANGE-AREA-5	SSJRNG005	JR50003GA	9/13/2010	SW6020	Tungsten	MG/KG	0.023	0.2	ND	U
MMR	J-RANGE-AREA-5	SSJRNG005	JR50003GA	9/13/2010	SW8330	Nitroglycerin	UG/KG	562	2040	2560	J
MMR	J-RANGE-AREA-5	SSJRNG005	JR50003GB	9/13/2010	SW6010B	Antimony	MG/KG	0.16	3	ND	U
MMR	J-RANGE-AREA-5	SSJRNG005	JR50003GB	9/13/2010	SW6010B	Copper	MG/KG	0.1	1.2	6.4	
MMR	J-RANGE-AREA-5	SSJRNG005	JR50003GB	9/13/2010	SW6010B	Lead	MG/KG	0.18	0.5	38.6	
MMR	J-RANGE-AREA-5	SSJRNG005	JR50003GB	9/13/2010	SW6010B	Zinc	MG/KG	0.047	1	22.6	
MMR	J-RANGE-AREA-5	SSJRNG005	JR50003GB	9/13/2010	SW6020	Tungsten	MG/KG	0.023	0.2	ND	U
MMR	J-RANGE-AREA-5	SSJRNG005	JR50003GB	9/13/2010	SW8330	Nitroglycerin	UG/KG	551	2000	2470	J
MMR	J-RANGE-AREA-5	SSJRNG005	JR50003GC	9/13/2010	SW6010B	Antimony	MG/KG	0.17	3	ND	U
MMR	J-RANGE-AREA-5	SSJRNG005	JR50003GC	9/13/2010	SW6010B	Copper	MG/KG	0.11	1.3	9.5	
MMR	J-RANGE-AREA-5	SSJRNG005	JR50003GC	9/13/2010	SW6010B	Lead	MG/KG	0.18	0.51	36	
MMR	J-RANGE-AREA-5	SSJRNG005	JR50003GC	9/13/2010	SW6010B	Zinc	MG/KG	0.047	1	22.4	
MMR	J-RANGE-AREA-5	SSJRNG005	JR50003GC	9/13/2010	SW6020	Tungsten	MG/KG	0.023	0.2	ND	U
MMR	J-RANGE-AREA-5	SSJRNG005	JR50003GC	9/13/2010	SW8330	Nitroglycerin	UG/KG	537	1950	ND	UJ
MMR	J-RANGE-AREA-5	SSJRNG005	JR50003UA	9/13/2010	SW6010B	Antimony	MG/KG	0.16	3	ND	U
MMR	J-RANGE-AREA-5	SSJRNG005	JR50003UA	9/13/2010	SW6010B	Copper	MG/KG	0.1	1.2	5.4	
MMR	J-RANGE-AREA-5	SSJRNG005	JR50003UA	9/13/2010	SW6010B	Lead	MG/KG	0.18	0.5	37.2	
MMR	J-RANGE-AREA-5	SSJRNG005	JR50003UA	9/13/2010	SW6010B	Zinc	MG/KG	0.047	1	24	
MMR	J-RANGE-AREA-5	SSJRNG005	JR50003UA	9/13/2010	SW6020	Tungsten	MG/KG	0.023	0.2	ND	U
MMR	J-RANGE-AREA-6	SSJRNG006	JR60003GA	9/14/2010	SW6010B	Antimony	MG/KG	0.16	3	ND	U
MMR	J-RANGE-AREA-6	SSJRNG006	JR60003GA	9/14/2010	SW6010B	Copper	MG/KG	0.1	1.2	7.7	

Table 1
J Range Validated Soil Data

AFIID	Location Description	LOC_ID	Sample ID	Sample Date	Analysis	Analyte	Units	MDL[1]	RL[2]	Result	Qualifiers[3]
MMR	J-RANGE-AREA-6	SSJRNG006	JR60003GA	9/14/2010	SW6010B	Lead	MG/KG	0.18	0.5	21.8	
MMR	J-RANGE-AREA-6	SSJRNG006	JR60003GA	9/14/2010	SW6010B	Zinc	MG/KG	0.047	1	16.7	
MMR	J-RANGE-AREA-6	SSJRNG006	JR60003GA	9/14/2010	SW6020	Tungsten	MG/KG	0.012	0.1	0.19	
MMR	J-RANGE-AREA-6	SSJRNG006	JR60003UA	9/14/2010	SW6010B	Antimony	MG/KG	0.16	2.9	0.66	J
MMR	J-RANGE-AREA-6	SSJRNG006	JR60003UA	9/14/2010	SW6010B	Copper	MG/KG	0.1	1.2	7	
MMR	J-RANGE-AREA-6	SSJRNG006	JR60003UA	9/14/2010	SW6010B	Lead	MG/KG	0.17	0.49	26	
MMR	J-RANGE-AREA-6	SSJRNG006	JR60003UA	9/14/2010	SW6010B	Zinc	MG/KG	0.046	0.98	19.6	
MMR	J-RANGE-AREA-6	SSJRNG006	JR60003UA	9/14/2010	SW6020	Tungsten	MG/KG	0.011	0.098	0.21	

Notes:

[1] MDL = Method Detection Limit.

[2] RL = Laboratory Reporting Limit.

[3] Qualifiers: U = analyte was not detected above this value. J = value is estimated because it is below the laboratory reporting limit or due to limitations identified in the data validation. UJ = the analyte was not detected above this value and the value is estimated due to limitations identified in the data validation. R = value was rejected due to major problems identified in the data validation.

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Table 2
J Range Validated Lysimeter Data

AFIID	Location Description	LOC_ID	Sample ID	Sample Date	Analysis	Analyte	Units	MDL[1]	RL[2]	Result	Qualifiers[3]
MMR	LY-JR-01	LYJRNG001	LYJR01A	10/8/2010	SW6010B	Antimony	UG/L	3.6	60	ND	U
MMR	LY-JR-01	LYJRNG001	LYJR01A	10/8/2010	SW6010B	Copper	UG/L	1.4	25	ND	U
MMR	LY-JR-01	LYJRNG001	LYJR01A	10/8/2010	SW6010B	Lead	UG/L	3.2	10	ND	U
MMR	LY-JR-01	LYJRNG001	LYJR01A	10/8/2010	SW6020	Tungsten	UG/L	0.3	2	ND	U
MMR	LY-JR-01	LYJRNG001	LYJR01A	10/8/2010	SW8330	Nitroglycerin	UG/L	0.97	6.2	ND	UJ
MMR	LY-JR-01	LYJRNG001	LYJR01D	10/8/2010	SW6010B	Antimony	UG/L	3.6	60	ND	U
MMR	LY-JR-01	LYJRNG001	LYJR01D	10/8/2010	SW6010B	Copper	UG/L	1.4	25	ND	U
MMR	LY-JR-01	LYJRNG001	LYJR01D	10/8/2010	SW6010B	Lead	UG/L	3.2	10	ND	U
MMR	LY-JR-01	LYJRNG001	LYJR01D	10/8/2010	SW6020	Tungsten	UG/L	0.3	2	ND	U
MMR	LY-JR-01	LYJRNG001	LYJR01D	10/8/2010	SW8330	Nitroglycerin	UG/L	0.93	3.8	ND	U
MMR	LY-JR-03	LYJRNG003	LYJR03A	10/8/2010	SW6010B	Antimony	UG/L	3.6	60	ND	U
MMR	LY-JR-03	LYJRNG003	LYJR03A	10/8/2010	SW6010B	Copper	UG/L	1.4	25	1.7	J
MMR	LY-JR-03	LYJRNG003	LYJR03A	10/8/2010	SW6010B	Lead	UG/L	3.2	10	ND	U
MMR	LY-JR-03	LYJRNG003	LYJR03A	10/8/2010	SW6020	Tungsten	UG/L	0.3	2	ND	U
MMR	LY-JR-03	LYJRNG003	LYJR03A	10/8/2010	SW8330	Nitroglycerin	UG/L	0.99	4.04	ND	U
MMR	LY-JR-02	LYJRNG002	LYJR02A	10/18/2010	SW6010B	Antimony	UG/L	3.6	60	ND	U
MMR	LY-JR-02	LYJRNG002	LYJR02A	10/18/2010	SW6010B	Copper	UG/L	1.4	25	ND	U
MMR	LY-JR-02	LYJRNG002	LYJR02A	10/18/2010	SW6010B	Lead	UG/L	3.2	10	ND	U
MMR	LY-JR-02	LYJRNG002	LYJR02A	10/18/2010	SW6020	Tungsten	UG/L	0.3	2	ND	U
MMR	LY-JR-02	LYJRNG002	LYJR02A	10/18/2010	SW8330	Nitroglycerin	UG/L	1.03	4.21	ND	U

Notes:

[1] MDL = Method Detection Limit.

[2] RL = Laboratory Reporting Limit.

[3] Qualifiers: U = analyte was not detected above this value. J = value is estimated because it is below the laboratory reporting limit or due to limitations identified in the data validation. UJ = the analyte was not detected above this value and the value is estimated due to limitations identified in the data validation. R = value was rejected due to major problems identified in the data validation.

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Table 3
K Range Validated Soil Data

AFIID	Location Description	LOC_ID	Sample ID	Sample Date	Analysis	Analyte	Units	MDL[1]	RL[2]	Result	Qualifiers[3]
MMR	K-RANGE-AREA-1	SSKRNG001	KR10003GA	9/14/2010	SW6010B	Antimony	MG/KG	0.16	3	ND	U
MMR	K-RANGE-AREA-1	SSKRNG001	KR10003GA	9/14/2010	SW6010B	Copper	MG/KG	0.1	1.2	13.9	
MMR	K-RANGE-AREA-1	SSKRNG001	KR10003GA	9/14/2010	SW6010B	Lead	MG/KG	0.17	0.5	31	
MMR	K-RANGE-AREA-1	SSKRNG001	KR10003GA	9/14/2010	SW6010B	Zinc	MG/KG	0.047	1	26.7	
MMR	K-RANGE-AREA-1	SSKRNG001	KR10003GA	9/14/2010	SW6020	Tungsten	MG/KG	0.011	0.1	0.19	
MMR	K-RANGE-AREA-1	SSKRNG001	KR10003GA	9/14/2010	SW8330	Nitroglycerin	UG/KG	551	2000	5290	
MMR	K-RANGE-AREA-1	SSKRNG001	KR10003GB	9/14/2010	SW6010B	Antimony	MG/KG	0.16	3	ND	U
MMR	K-RANGE-AREA-1	SSKRNG001	KR10003GB	9/14/2010	SW6010B	Copper	MG/KG	0.1	1.2	13.6	
MMR	K-RANGE-AREA-1	SSKRNG001	KR10003GB	9/14/2010	SW6010B	Lead	MG/KG	0.17	0.49	17.3	
MMR	K-RANGE-AREA-1	SSKRNG001	KR10003GB	9/14/2010	SW6010B	Zinc	MG/KG	0.046	0.99	27.5	
MMR	K-RANGE-AREA-1	SSKRNG001	KR10003GB	9/14/2010	SW6020	Tungsten	MG/KG	0.011	0.1	ND	U
MMR	K-RANGE-AREA-1	SSKRNG001	KR10003GB	9/14/2010	SW8330	Nitroglycerin	UG/KG	545	1980	4050	J
MMR	K-RANGE-AREA-1	SSKRNG001	KR10003GC	9/14/2010	SW6010B	Antimony	MG/KG	0.16	3	ND	U
MMR	K-RANGE-AREA-1	SSKRNG001	KR10003GC	9/14/2010	SW6010B	Copper	MG/KG	0.1	1.2	13.4	
MMR	K-RANGE-AREA-1	SSKRNG001	KR10003GC	9/14/2010	SW6010B	Lead	MG/KG	0.18	0.5	16.2	
MMR	K-RANGE-AREA-1	SSKRNG001	KR10003GC	9/14/2010	SW6010B	Zinc	MG/KG	0.047	1	25	
MMR	K-RANGE-AREA-1	SSKRNG001	KR10003GC	9/14/2010	SW6020	Tungsten	MG/KG	0.012	0.1	ND	U
MMR	K-RANGE-AREA-1	SSKRNG001	KR10003GC	9/14/2010	SW8330	Nitroglycerin	UG/KG	537	1950	3040	
MMR	K-RANGE-AREA-1	SSKRNG001	KR10003UA	9/14/2010	SW6010B	Antimony	MG/KG	0.16	3	ND	U
MMR	K-RANGE-AREA-1	SSKRNG001	KR10003UA	9/14/2010	SW6010B	Copper	MG/KG	0.1	1.2	23	
MMR	K-RANGE-AREA-1	SSKRNG001	KR10003UA	9/14/2010	SW6010B	Lead	MG/KG	0.18	0.5	22	
MMR	K-RANGE-AREA-1	SSKRNG001	KR10003UA	9/14/2010	SW6010B	Zinc	MG/KG	0.047	1	27	
MMR	K-RANGE-AREA-1	SSKRNG001	KR10003UA	9/14/2010	SW6020	Tungsten	MG/KG	0.012	0.1	ND	U
MMR	K-RANGE-AREA-2	SSKRNG002	KR20003GA	9/14/2010	SW6010B	Antimony	MG/KG	0.17	3	ND	U
MMR	K-RANGE-AREA-2	SSKRNG002	KR20003GA	9/14/2010	SW6010B	Copper	MG/KG	0.11	1.3	7	
MMR	K-RANGE-AREA-2	SSKRNG002	KR20003GA	9/14/2010	SW6010B	Lead	MG/KG	0.18	0.5	26.8	
MMR	K-RANGE-AREA-2	SSKRNG002	KR20003GA	9/14/2010	SW6010B	Zinc	MG/KG	0.047	1	17.3	
MMR	K-RANGE-AREA-2	SSKRNG002	KR20003GA	9/14/2010	SW6020	Tungsten	MG/KG	0.023	0.2	ND	U
MMR	K-RANGE-AREA-2	SSKRNG002	KR20003GA	9/14/2010	SW8330	Nitroglycerin	UG/KG	547	1990	ND	UJ
MMR	K-RANGE-AREA-2	SSKRNG002	KR20003UA	9/14/2010	SW6010B	Antimony	MG/KG	0.16	3	ND	U
MMR	K-RANGE-AREA-2	SSKRNG002	KR20003UA	9/14/2010	SW6010B	Copper	MG/KG	0.1	1.2	5.7	
MMR	K-RANGE-AREA-2	SSKRNG002	KR20003UA	9/14/2010	SW6010B	Lead	MG/KG	0.17	0.5	25.7	

Table 3
K Range Validated Soil Data

AFIID	Location Description	LOC_ID	Sample ID	Sample Date	Analysis	Analyte	Units	MDL[1]	RL[2]	Result	Qualifiers[3]
MMR	K-RANGE-AREA-2	SSKRNG002	KR20003UA	9/14/2010	SW6010B	Zinc	MG/KG	0.047	1	17.5	
MMR	K-RANGE-AREA-2	SSKRNG002	KR20003UA	9/14/2010	SW6020	Tungsten	MG/KG	0.023	0.2	ND	U
MMR	K-RANGE-AREA-3	SSKRNG003	KR30003GA	9/15/2010	SW6010B	Antimony	MG/KG	0.16	3	ND	U
MMR	K-RANGE-AREA-3	SSKRNG003	KR30003GA	9/15/2010	SW6010B	Copper	MG/KG	0.1	1.2	5.7	
MMR	K-RANGE-AREA-3	SSKRNG003	KR30003GA	9/15/2010	SW6010B	Lead	MG/KG	0.17	0.5	26.9	
MMR	K-RANGE-AREA-3	SSKRNG003	KR30003GA	9/15/2010	SW6010B	Zinc	MG/KG	0.047	0.99	17.1	
MMR	K-RANGE-AREA-3	SSKRNG003	KR30003GA	9/15/2010	SW6020	Tungsten	MG/KG	0.023	0.2	ND	U
MMR	K-RANGE-AREA-3	SSKRNG003	KR30003GA	9/15/2010	SW8330	Nitroglycerin	UG/KG	548	2210	ND	UJ
MMR	K-RANGE-AREA-3	SSKRNG003	KR30003GB	9/15/2010	SW6010B	Antimony	MG/KG	0.16	3	ND	U
MMR	K-RANGE-AREA-3	SSKRNG003	KR30003GB	9/15/2010	SW6010B	Copper	MG/KG	0.1	1.2	5.7	
MMR	K-RANGE-AREA-3	SSKRNG003	KR30003GB	9/15/2010	SW6010B	Lead	MG/KG	0.18	0.5	25.4	
MMR	K-RANGE-AREA-3	SSKRNG003	KR30003GB	9/15/2010	SW6010B	Zinc	MG/KG	0.047	1	16.9	
MMR	K-RANGE-AREA-3	SSKRNG003	KR30003GB	9/15/2010	SW6020	Tungsten	MG/KG	0.023	0.2	ND	U
MMR	K-RANGE-AREA-3	SSKRNG003	KR30003GB	9/15/2010	SW8330	Nitroglycerin	UG/KG	549	2000	ND	UJ
MMR	K-RANGE-AREA-3	SSKRNG003	KR30003GC	9/16/2010	SW6010B	Antimony	MG/KG	0.16	3	ND	U
MMR	K-RANGE-AREA-3	SSKRNG003	KR30003GC	9/16/2010	SW6010B	Copper	MG/KG	0.1	1.2	6.7	
MMR	K-RANGE-AREA-3	SSKRNG003	KR30003GC	9/16/2010	SW6010B	Lead	MG/KG	0.18	0.5	24.6	
MMR	K-RANGE-AREA-3	SSKRNG003	KR30003GC	9/16/2010	SW6010B	Zinc	MG/KG	0.047	1	16.9	
MMR	K-RANGE-AREA-3	SSKRNG003	KR30003GC	9/16/2010	SW6020	Tungsten	MG/KG	0.023	0.2	ND	U
MMR	K-RANGE-AREA-3	SSKRNG003	KR30003GC	9/16/2010	SW8330	Nitroglycerin	UG/KG	552	2010	ND	U
MMR	K-RANGE-AREA-3	SSKRNG003	KR30003UA	9/15/2010	SW6010B	Antimony	MG/KG	0.16	3	ND	U
MMR	K-RANGE-AREA-3	SSKRNG003	KR30003UA	9/15/2010	SW6010B	Copper	MG/KG	0.1	1.2	5.8	
MMR	K-RANGE-AREA-3	SSKRNG003	KR30003UA	9/15/2010	SW6010B	Lead	MG/KG	0.18	0.5	25	
MMR	K-RANGE-AREA-3	SSKRNG003	KR30003UA	9/15/2010	SW6010B	Zinc	MG/KG	0.047	1	18.9	
MMR	K-RANGE-AREA-3	SSKRNG003	KR30003UA	9/15/2010	SW6020	Tungsten	MG/KG	0.023	0.2	ND	U
MMR	K-RANGE-AREA-4	SSKRNG004	KR40003GA	9/15/2010	SW6010B	Antimony	MG/KG	0.16	3	ND	U
MMR	K-RANGE-AREA-4	SSKRNG004	KR40003GA	9/15/2010	SW6010B	Copper	MG/KG	0.1	1.2	10.9	
MMR	K-RANGE-AREA-4	SSKRNG004	KR40003GA	9/15/2010	SW6010B	Lead	MG/KG	0.17	0.5	28.2	
MMR	K-RANGE-AREA-4	SSKRNG004	KR40003GA	9/15/2010	SW6010B	Zinc	MG/KG	0.047	1	18.8	
MMR	K-RANGE-AREA-4	SSKRNG004	KR40003GA	9/15/2010	SW6020	Tungsten	MG/KG	0.023	0.2	ND	U
MMR	K-RANGE-AREA-4	SSKRNG004	KR40003GA	9/15/2010	SW8330	Nitroglycerin	UG/KG	550	2000	ND	UJ
MMR	K-RANGE-AREA-4	SSKRNG004	KR40003UA	9/15/2010	SW6010B	Antimony	MG/KG	0.16	2.9	ND	U

Table 3
K Range Validated Soil Data

AFIID	Location Description	LOC_ID	Sample ID	Sample Date	Analysis	Analyte	Units	MDL[1]	RL[2]	Result	Qualifiers[3]
MMR	K-RANGE-AREA-4	SSKRNG004	KR40003UA	9/15/2010	SW6010B	Copper	MG/KG	0.1	1.2	5.9	
MMR	K-RANGE-AREA-4	SSKRNG004	KR40003UA	9/15/2010	SW6010B	Lead	MG/KG	0.17	0.49	25.1	
MMR	K-RANGE-AREA-4	SSKRNG004	KR40003UA	9/15/2010	SW6010B	Zinc	MG/KG	0.046	0.98	16.8	
MMR	K-RANGE-AREA-4	SSKRNG004	KR40003UA	9/15/2010	SW6020	Tungsten	MG/KG	0.023	0.2	ND	U
MMR	K-RANGE-AREA-5	SSKRNG005	KR50003GA	9/16/2010	SW6010B	Antimony	MG/KG	0.17	3	ND	U
MMR	K-RANGE-AREA-5	SSKRNG005	KR50003GA	9/16/2010	SW6010B	Copper	MG/KG	0.11	1.3	5.9	
MMR	K-RANGE-AREA-5	SSKRNG005	KR50003GA	9/16/2010	SW6010B	Lead	MG/KG	0.18	0.5	27.1	
MMR	K-RANGE-AREA-5	SSKRNG005	KR50003GA	9/16/2010	SW6010B	Zinc	MG/KG	0.047	1	17.5	
MMR	K-RANGE-AREA-5	SSKRNG005	KR50003GA	9/16/2010	SW6020	Tungsten	MG/KG	0.023	0.2	ND	U
MMR	K-RANGE-AREA-5	SSKRNG005	KR50003GA	9/16/2010	SW8330	Nitroglycerin	UG/KG	546	1980	ND	UJ
MMR	K-RANGE-AREA-5	SSKRNG005	KR50003GB	9/16/2010	SW6010B	Antimony	MG/KG	0.16	3	ND	U
MMR	K-RANGE-AREA-5	SSKRNG005	KR50003GB	9/16/2010	SW6010B	Copper	MG/KG	0.1	1.2	7.3	
MMR	K-RANGE-AREA-5	SSKRNG005	KR50003GB	9/16/2010	SW6010B	Lead	MG/KG	0.17	0.5	25.9	
MMR	K-RANGE-AREA-5	SSKRNG005	KR50003GB	9/16/2010	SW6010B	Zinc	MG/KG	0.047	1	17	
MMR	K-RANGE-AREA-5	SSKRNG005	KR50003GB	9/16/2010	SW6020	Tungsten	MG/KG	0.023	0.2	ND	U
MMR	K-RANGE-AREA-5	SSKRNG005	KR50003GB	9/16/2010	SW8330	Nitroglycerin	UG/KG	551	2300	ND	UJ
MMR	K-RANGE-AREA-5	SSKRNG005	KR50003GC	9/16/2010	SW6010B	Antimony	MG/KG	0.17	3	ND	U
MMR	K-RANGE-AREA-5	SSKRNG005	KR50003GC	9/16/2010	SW6010B	Copper	MG/KG	0.11	1.3	6	
MMR	K-RANGE-AREA-5	SSKRNG005	KR50003GC	9/16/2010	SW6010B	Lead	MG/KG	0.18	0.5	25.6	
MMR	K-RANGE-AREA-5	SSKRNG005	KR50003GC	9/16/2010	SW6010B	Zinc	MG/KG	0.047	1	17.3	
MMR	K-RANGE-AREA-5	SSKRNG005	KR50003GC	9/16/2010	SW6020	Tungsten	MG/KG	0.023	0.2	ND	U
MMR	K-RANGE-AREA-5	SSKRNG005	KR50003GC	9/16/2010	SW8330	Nitroglycerin	UG/KG	542	1970	ND	U
MMR	K-RANGE-AREA-5	SSKRNG005	KR50003UA	9/16/2010	SW6010B	Antimony	MG/KG	0.16	3	ND	U
MMR	K-RANGE-AREA-5	SSKRNG005	KR50003UA	9/16/2010	SW6010B	Copper	MG/KG	0.1	1.2	6.3	
MMR	K-RANGE-AREA-5	SSKRNG005	KR50003UA	9/16/2010	SW6010B	Lead	MG/KG	0.18	0.5	27.9	
MMR	K-RANGE-AREA-5	SSKRNG005	KR50003UA	9/16/2010	SW6010B	Zinc	MG/KG	0.047	1	18.8	
MMR	K-RANGE-AREA-5	SSKRNG005	KR50003UA	9/16/2010	SW6020	Tungsten	MG/KG	0.023	0.2	ND	U
MMR	K-RANGE-AREA-6	SSKRNG006	KR60003GA	9/16/2010	SW6010B	Antimony	MG/KG	0.16	3	ND	U
MMR	K-RANGE-AREA-6	SSKRNG006	KR60003GA	9/16/2010	SW6010B	Copper	MG/KG	0.1	1.2	7.8	
MMR	K-RANGE-AREA-6	SSKRNG006	KR60003GA	9/16/2010	SW6010B	Lead	MG/KG	0.17	0.5	16.3	
MMR	K-RANGE-AREA-6	SSKRNG006	KR60003GA	9/16/2010	SW6010B	Zinc	MG/KG	0.047	1	19.5	
MMR	K-RANGE-AREA-6	SSKRNG006	KR60003GA	9/16/2010	SW6020	Tungsten	MG/KG	0.023	0.2	ND	U

Table 3
K Range Validated Soil Data

AFIID	Location Description	LOC_ID	Sample ID	Sample Date	Analysis	Analyte	Units	MDL[1]	RL[2]	Result	Qualifiers[3]
MMR	K-RANGE-AREA-6	SSKRNG006	KR60003UA	9/16/2010	SW6010B	Antimony	MG/KG	0.16	3	ND	U
MMR	K-RANGE-AREA-6	SSKRNG006	KR60003UA	9/16/2010	SW6010B	Copper	MG/KG	0.1	1.2	5.3	
MMR	K-RANGE-AREA-6	SSKRNG006	KR60003UA	9/16/2010	SW6010B	Lead	MG/KG	0.17	0.5	15.3	
MMR	K-RANGE-AREA-6	SSKRNG006	KR60003UA	9/16/2010	SW6010B	Zinc	MG/KG	0.047	1	20.3	
MMR	K-RANGE-AREA-6	SSKRNG006	KR60003UA	9/16/2010	SW6020	Tungsten	MG/KG	0.023	0.2	ND	U

Notes:

[1] MDL = Method Detection Limit.

[2] RL = Laboratory Reporting Limit.

[3] Qualifiers: U = analyte was not detected above this value. J = value is estimated because it is below the laboratory reporting limit or due to limitations identified in the data validation. UJ = the analyte was not detected above this value and the value is estimated due to limitations identified in the data validation. R = value was rejected due to major problems identified in the data validation.

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Table 4
K Range Validated Lysimeter Data

AFIID	Location Description	LOC_ID	Sample ID	Sample Date	Analysis	Analyte	Units	MDL[1]	RL[2]	Result	Qualifiers[3]
MMR	LY-KR-01	LYKRNG001	LYKR01A	10/8/2010	SW6010B	Antimony	UG/L	3.6	60	ND	U
MMR	LY-KR-01	LYKRNG001	LYKR01A	10/8/2010	SW6010B	Copper	UG/L	1.4	25	15.8	J
MMR	LY-KR-01	LYKRNG001	LYKR01A	10/8/2010	SW6010B	Lead	UG/L	3.2	10	ND	U
MMR	LY-KR-01	LYKRNG001	LYKR01A	10/8/2010	SW6020	Tungsten	UG/L	0.3	2	ND	U
MMR	LY-KR-01	LYKRNG001	LYKR01A	10/8/2010	SW8330	Nitroglycerin	UG/L	2.72	11.1	ND	U
MMR	LY-KR-03	LYKRNG003	LYKR03A	10/8/2010	SW6010B	Antimony	UG/L	3.6	60	ND	U
MMR	LY-KR-03	LYKRNG003	LYKR03A	10/8/2010	SW6010B	Copper	UG/L	1.4	25	ND	U
MMR	LY-KR-03	LYKRNG003	LYKR03A	10/8/2010	SW6010B	Lead	UG/L	3.2	10	4.1	J
MMR	LY-KR-03	LYKRNG003	LYKR03A	10/8/2010	SW6020	Tungsten	UG/L	0.3	2	ND	U
MMR	LY-KR-03	LYKRNG003	LYKR03A	10/8/2010	SW8330	Nitroglycerin	UG/L	1.04	14.5	ND	UJ
MMR	LY-KR-04	LYKRNG004	LYKR04A	10/8/2010	SW6010B	Antimony	UG/L	3.6	60	ND	U
MMR	LY-KR-04	LYKRNG004	LYKR04A	10/8/2010	SW6010B	Copper	UG/L	1.4	25	5.7	J
MMR	LY-KR-04	LYKRNG004	LYKR04A	10/8/2010	SW6010B	Lead	UG/L	3.2	10	5.8	J
MMR	LY-KR-04	LYKRNG004	LYKR04A	10/8/2010	SW6020	Tungsten	UG/L	0.3	2	ND	U
MMR	LY-KR-04	LYKRNG004	LYKR04A	10/8/2010	SW8330	Nitroglycerin	UG/L	0.96	4.2	ND	UJ
MMR	LY-KR-02	LYKRNG002	LYKR02A	10/18/2010	SW6010B	Antimony	UG/L	3.6	60	ND	U
MMR	LY-KR-02	LYKRNG002	LYKR02A	10/18/2010	SW6010B	Copper	UG/L	1.4	25	ND	U
MMR	LY-KR-02	LYKRNG002	LYKR02A	10/18/2010	SW6010B	Lead	UG/L	3.2	10	ND	U
MMR	LY-KR-02	LYKRNG002	LYKR02A	10/18/2010	SW6020	Tungsten	UG/L	0.3	2	ND	U
MMR	LY-KR-02	LYKRNG002	LYKR02A	10/18/2010	SW8330	Nitroglycerin	UG/L	0.98	4	ND	U

Notes:

[1] MDL = Method Detection Limit.

[2] RL = Laboratory Reporting Limit.

[3] Qualifiers: U = analyte was not detected above this value. J = value is estimated because it is below the laboratory reporting limit or due to limitations identified in the data validation. UJ = the analyte was not detected above this value and the value is estimated due to limitations identified in the data validation. R = value was rejected due to major problems identified in the data validation.

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Table 5
T Range Validated Soil Data

AFIID	Location Description	LOC_ID	Sample ID	Sample Date	Analysis	Analyte	Units	MDL[1]	RL[2]	Result	Qualifiers[3]
MMR	T RANGE AREA 1A	SSTRNGA1A	TR1A0003GA	8/24/2010	SW6010B	Antimony	MG/KG	0.16	2.9	ND	R
MMR	T RANGE AREA 1A	SSTRNGA1A	TR1A0003GA	8/24/2010	SW6010B	Copper	MG/KG	0.1	1.2	19.6	J
MMR	T RANGE AREA 1A	SSTRNGA1A	TR1A0003GA	8/24/2010	SW6010B	Lead	MG/KG	0.17	0.49	19.5	
MMR	T RANGE AREA 1A	SSTRNGA1A	TR1A0003GA	8/24/2010	SW6010B	Zinc	MG/KG	0.046	0.98	31.5	
MMR	T RANGE AREA 1A	SSTRNGA1A	TR1A0003GA	8/24/2010	SW6020	Tungsten	MG/KG	0.023	0.2	ND	UJ
MMR	T RANGE AREA 1A	SSTRNGA1A	TR1A0003GA	8/24/2010	SW8330	Nitroglycerin	UG/KG	547	1990	16700	
MMR	T RANGE AREA 1A	SSTRNGA1A	TR1A0003GB	8/25/2010	SW6010B	Antimony	MG/KG	0.16	3	ND	U
MMR	T RANGE AREA 1A	SSTRNGA1A	TR1A0003GB	8/25/2010	SW6010B	Copper	MG/KG	0.1	1.2	18.8	
MMR	T RANGE AREA 1A	SSTRNGA1A	TR1A0003GB	8/25/2010	SW6010B	Lead	MG/KG	0.18	0.5	18.6	
MMR	T RANGE AREA 1A	SSTRNGA1A	TR1A0003GB	8/25/2010	SW6010B	Zinc	MG/KG	0.047	1	29.6	
MMR	T RANGE AREA 1A	SSTRNGA1A	TR1A0003GB	8/25/2010	SW6020	Tungsten	MG/KG	0.023	0.2	ND	U
MMR	T RANGE AREA 1A	SSTRNGA1A	TR1A0003GB	8/25/2010	SW8330	Nitroglycerin	UG/KG	549	2000	26000	
MMR	T RANGE AREA 1A	SSTRNGA1A	TR1A0003GC	8/25/2010	SW6010B	Antimony	MG/KG	0.16	3	ND	U
MMR	T RANGE AREA 1A	SSTRNGA1A	TR1A0003GC	8/25/2010	SW6010B	Copper	MG/KG	0.1	1.2	17.6	
MMR	T RANGE AREA 1A	SSTRNGA1A	TR1A0003GC	8/25/2010	SW6010B	Lead	MG/KG	0.18	0.5	23.9	
MMR	T RANGE AREA 1A	SSTRNGA1A	TR1A0003GC	8/25/2010	SW6010B	Zinc	MG/KG	0.047	1	30.7	
MMR	T RANGE AREA 1A	SSTRNGA1A	TR1A0003GC	8/25/2010	SW6020	Tungsten	MG/KG	0.023	0.2	ND	U
MMR	T RANGE AREA 1A	SSTRNGA1A	TR1A0003GC	8/25/2010	SW8330	Nitroglycerin	UG/KG	548	1990	15700	
MMR	T RANGE AREA 1A	SSTRNGA1A	TR1A0003UA	8/24/2010	SW6010B	Antimony	MG/KG	0.16	3	ND	U
MMR	T RANGE AREA 1A	SSTRNGA1A	TR1A0003UA	8/24/2010	SW6010B	Copper	MG/KG	0.1	1.2	20.7	
MMR	T RANGE AREA 1A	SSTRNGA1A	TR1A0003UA	8/24/2010	SW6010B	Lead	MG/KG	0.18	0.5	23.1	
MMR	T RANGE AREA 1A	SSTRNGA1A	TR1A0003UA	8/24/2010	SW6010B	Zinc	MG/KG	0.047	1	34	
MMR	T RANGE AREA 1A	SSTRNGA1A	TR1A0003UA	8/24/2010	SW6020	Tungsten	MG/KG	0.023	0.2	ND	U
MMR	T RANGE AREA 1B	SSTRNGA1B	TR1B0003GA	8/26/2010	SW6010B	Antimony	MG/KG	0.16	3	ND	U
MMR	T RANGE AREA 1B	SSTRNGA1B	TR1B0003GA	8/26/2010	SW6010B	Copper	MG/KG	0.1	1.2	8.8	
MMR	T RANGE AREA 1B	SSTRNGA1B	TR1B0003GA	8/26/2010	SW6010B	Lead	MG/KG	0.18	0.5	16.3	
MMR	T RANGE AREA 1B	SSTRNGA1B	TR1B0003GA	8/26/2010	SW6010B	Zinc	MG/KG	0.047	1	23	
MMR	T RANGE AREA 1B	SSTRNGA1B	TR1B0003GA	8/26/2010	SW6020	Tungsten	MG/KG	0.012	0.1	0.18	
MMR	T RANGE AREA 1B	SSTRNGA1B	TR1B0003GA	8/26/2010	SW8330	Nitroglycerin	UG/KG	549	2000	6000	J
MMR	T RANGE AREA 1B	SSTRNGA1B	TR1B0003GB	8/26/2010	SW6010B	Antimony	MG/KG	0.16	3	ND	U
MMR	T RANGE AREA 1B	SSTRNGA1B	TR1B0003GB	8/26/2010	SW6010B	Copper	MG/KG	0.1	1.2	9.6	
MMR	T RANGE AREA 1B	SSTRNGA1B	TR1B0003GB	8/26/2010	SW6010B	Lead	MG/KG	0.18	0.5	17.3	

Table 5
T Range Validated Soil Data

AFIID	Location Description	LOC_ID	Sample ID	Sample Date	Analysis	Analyte	Units	MDL[1]	RL[2]	Result	Qualifiers[3]
MMR	T RANGE AREA 1B	SSTRNGA1B	TR1B0003GB	8/26/2010	SW6010B	Zinc	MG/KG	0.047	1	24.5	
MMR	T RANGE AREA 1B	SSTRNGA1B	TR1B0003GB	8/26/2010	SW6020	Tungsten	MG/KG	0.012	0.1	0.11	
MMR	T RANGE AREA 1B	SSTRNGA1B	TR1B0003GB	8/26/2010	SW8330	Nitroglycerin	UG/KG	548	1990	5750	J
MMR	T RANGE AREA 1B	SSTRNGA1B	TR1B0003GC	8/26/2010	SW6010B	Antimony	MG/KG	0.16	3	ND	U
MMR	T RANGE AREA 1B	SSTRNGA1B	TR1B0003GC	8/26/2010	SW6010B	Copper	MG/KG	0.1	1.2	9.6	
MMR	T RANGE AREA 1B	SSTRNGA1B	TR1B0003GC	8/26/2010	SW6010B	Lead	MG/KG	0.17	0.5	22.3	
MMR	T RANGE AREA 1B	SSTRNGA1B	TR1B0003GC	8/26/2010	SW6010B	Zinc	MG/KG	0.047	1	25.3	
MMR	T RANGE AREA 1B	SSTRNGA1B	TR1B0003GC	8/26/2010	SW6020	Tungsten	MG/KG	0.011	0.1	0.12	
MMR	T RANGE AREA 1B	SSTRNGA1B	TR1B0003GC	8/26/2010	SW8330	Nitroglycerin	UG/KG	548	1990	5260	J
MMR	T RANGE AREA 1B	SSTRNGA1B	TR1B0003UA	8/26/2010	SW6010B	Antimony	MG/KG	0.16	2.9	ND	U
MMR	T RANGE AREA 1B	SSTRNGA1B	TR1B0003UA	8/26/2010	SW6010B	Copper	MG/KG	0.1	1.2	8.1	
MMR	T RANGE AREA 1B	SSTRNGA1B	TR1B0003UA	8/26/2010	SW6010B	Lead	MG/KG	0.17	0.49	16.3	
MMR	T RANGE AREA 1B	SSTRNGA1B	TR1B0003UA	8/26/2010	SW6010B	Zinc	MG/KG	0.046	0.98	30.1	
MMR	T RANGE AREA 1B	SSTRNGA1B	TR1B0003UA	8/26/2010	SW6020	Tungsten	MG/KG	0.011	0.098	ND	U
MMR	T RANGE AREA 1C	SSTRNGA1C	TR1C0003GA	8/27/2010	SW6010B	Antimony	MG/KG	0.16	3	1.2	J
MMR	T RANGE AREA 1C	SSTRNGA1C	TR1C0003GA	8/27/2010	SW6010B	Copper	MG/KG	0.1	1.2	94.8	
MMR	T RANGE AREA 1C	SSTRNGA1C	TR1C0003GA	8/27/2010	SW6010B	Lead	MG/KG	0.17	0.49	262	
MMR	T RANGE AREA 1C	SSTRNGA1C	TR1C0003GA	8/27/2010	SW6010B	Zinc	MG/KG	0.046	0.99	30.5	
MMR	T RANGE AREA 1C	SSTRNGA1C	TR1C0003GA	8/27/2010	SW6020	Tungsten	MG/KG	0.011	0.099	1.7	
MMR	T RANGE AREA 1C	SSTRNGA1C	TR1C0003GA	8/27/2010	SW8330	Nitroglycerin	UG/KG	547	1990	13000	
MMR	T RANGE AREA 1C	SSTRNGA1C	TR1C0003GB	8/27/2010	SW6010B	Antimony	MG/KG	0.16	2.9	1.2	J
MMR	T RANGE AREA 1C	SSTRNGA1C	TR1C0003GB	8/27/2010	SW6010B	Copper	MG/KG	0.1	1.2	93.4	
MMR	T RANGE AREA 1C	SSTRNGA1C	TR1C0003GB	8/27/2010	SW6010B	Lead	MG/KG	0.17	0.49	279	
MMR	T RANGE AREA 1C	SSTRNGA1C	TR1C0003GB	8/27/2010	SW6010B	Zinc	MG/KG	0.046	0.98	30.3	
MMR	T RANGE AREA 1C	SSTRNGA1C	TR1C0003GB	8/27/2010	SW6020	Tungsten	MG/KG	0.011	0.098	1.9	
MMR	T RANGE AREA 1C	SSTRNGA1C	TR1C0003GB	8/27/2010	SW8330	Nitroglycerin	UG/KG	546	1990	10500	
MMR	T RANGE AREA 1C	SSTRNGA1C	TR1C0003GC	8/27/2010	SW6010B	Antimony	MG/KG	0.16	3	4.5	
MMR	T RANGE AREA 1C	SSTRNGA1C	TR1C0003GC	8/27/2010	SW6010B	Copper	MG/KG	0.1	1.2	124	
MMR	T RANGE AREA 1C	SSTRNGA1C	TR1C0003GC	8/27/2010	SW6010B	Lead	MG/KG	0.35	0.99	1090	
MMR	T RANGE AREA 1C	SSTRNGA1C	TR1C0003GC	8/27/2010	SW6010B	Zinc	MG/KG	0.047	0.99	34.7	
MMR	T RANGE AREA 1C	SSTRNGA1C	TR1C0003GC	8/27/2010	SW6020	Tungsten	MG/KG	0.057	0.5	3.3	
MMR	T RANGE AREA 1C	SSTRNGA1C	TR1C0003GC	8/27/2010	SW8330	Nitroglycerin	UG/KG	549	2000	9420	

Table 5
T Range Validated Soil Data

AFIID	Location Description	LOC_ID	Sample ID	Sample Date	Analysis	Analyte	Units	MDL[1]	RL[2]	Result	Qualifiers[3]
MMR	T RANGE AREA 1C	SSTRNGA1C	TR1C0003UA	8/27/2010	SW6010B	Antimony	MG/KG	0.16	3	4.1	
MMR	T RANGE AREA 1C	SSTRNGA1C	TR1C0003UA	8/27/2010	SW6010B	Copper	MG/KG	0.1	1.2	68.8	
MMR	T RANGE AREA 1C	SSTRNGA1C	TR1C0003UA	8/27/2010	SW6010B	Lead	MG/KG	0.17	0.5	818	
MMR	T RANGE AREA 1C	SSTRNGA1C	TR1C0003UA	8/27/2010	SW6010B	Zinc	MG/KG	0.047	0.99	27.1	
MMR	T RANGE AREA 1C	SSTRNGA1C	TR1C0003UA	8/27/2010	SW6020	Tungsten	MG/KG	0.011	0.099	1.3	
MMR	T RANGE AREA 1D	SSTRNGA1D	TR1D0003GA	8/27/2010	SW6010B	Antimony	MG/KG	0.16	3	1.6	J
MMR	T RANGE AREA 1D	SSTRNGA1D	TR1D0003GA	8/27/2010	SW6010B	Copper	MG/KG	0.1	1.2	219	
MMR	T RANGE AREA 1D	SSTRNGA1D	TR1D0003GA	8/27/2010	SW6010B	Lead	MG/KG	0.17	0.49	328	
MMR	T RANGE AREA 1D	SSTRNGA1D	TR1D0003GA	8/27/2010	SW6010B	Zinc	MG/KG	0.046	0.99	27.2	
MMR	T RANGE AREA 1D	SSTRNGA1D	TR1D0003GA	8/27/2010	SW6020	Tungsten	MG/KG	0.11	0.99	11.7	
MMR	T RANGE AREA 1D	SSTRNGA1D	TR1D0003GA	8/27/2010	SW8330	Nitroglycerin	UG/KG	547	1990	14600	
MMR	T RANGE AREA 1D	SSTRNGA1D	TR1D0003GB	8/27/2010	SW6010B	Antimony	MG/KG	0.16	3	2.7	J
MMR	T RANGE AREA 1D	SSTRNGA1D	TR1D0003GB	8/27/2010	SW6010B	Copper	MG/KG	0.1	1.2	174	
MMR	T RANGE AREA 1D	SSTRNGA1D	TR1D0003GB	8/27/2010	SW6010B	Lead	MG/KG	0.17	0.5	559	
MMR	T RANGE AREA 1D	SSTRNGA1D	TR1D0003GB	8/27/2010	SW6010B	Zinc	MG/KG	0.047	1	41.7	
MMR	T RANGE AREA 1D	SSTRNGA1D	TR1D0003GB	8/27/2010	SW6020	Tungsten	MG/KG	0.23	2	16.1	
MMR	T RANGE AREA 1D	SSTRNGA1D	TR1D0003GB	8/27/2010	SW8330	Nitroglycerin	UG/KG	545	1980	9580	
MMR	T RANGE AREA 1D	SSTRNGA1D	TR1D0003GC	8/30/2010	SW6010B	Antimony	MG/KG	0.16	2.9	1.3	J
MMR	T RANGE AREA 1D	SSTRNGA1D	TR1D0003GC	8/30/2010	SW6010B	Copper	MG/KG	0.1	1.2	248	
MMR	T RANGE AREA 1D	SSTRNGA1D	TR1D0003GC	8/30/2010	SW6010B	Lead	MG/KG	0.17	0.49	368	J
MMR	T RANGE AREA 1D	SSTRNGA1D	TR1D0003GC	8/30/2010	SW6010B	Zinc	MG/KG	0.046	0.98	28.1	
MMR	T RANGE AREA 1D	SSTRNGA1D	TR1D0003GC	8/30/2010	SW6020	Tungsten	MG/KG	0.11	0.98	11.4	J
MMR	T RANGE AREA 1D	SSTRNGA1D	TR1D0003GC	8/30/2010	SW8330	Nitroglycerin	UG/KG	545	1980	12200	
MMR	T RANGE AREA 1D	SSTRNGA1D	TR1D0003UA	8/27/2010	SW6010B	Antimony	MG/KG	0.16	3	2.9	J
MMR	T RANGE AREA 1D	SSTRNGA1D	TR1D0003UA	8/27/2010	SW6010B	Copper	MG/KG	0.1	1.2	255	
MMR	T RANGE AREA 1D	SSTRNGA1D	TR1D0003UA	8/27/2010	SW6010B	Lead	MG/KG	0.34	0.99	1330	
MMR	T RANGE AREA 1D	SSTRNGA1D	TR1D0003UA	8/27/2010	SW6010B	Zinc	MG/KG	0.046	0.99	26.8	
MMR	T RANGE AREA 1D	SSTRNGA1D	TR1D0003UA	8/27/2010	SW6020	Tungsten	MG/KG	1.1	9.9	43.5	
MMR	T RANGE AREA 1E	SSTRNGA1E	TR1E0003GA	8/27/2010	SW6010B	Antimony	MG/KG	0.16	3	1.3	J
MMR	T RANGE AREA 1E	SSTRNGA1E	TR1E0003GA	8/27/2010	SW6010B	Copper	MG/KG	0.1	1.2	38.5	
MMR	T RANGE AREA 1E	SSTRNGA1E	TR1E0003GA	8/27/2010	SW6010B	Lead	MG/KG	0.18	0.5	202	
MMR	T RANGE AREA 1E	SSTRNGA1E	TR1E0003GA	8/27/2010	SW6010B	Zinc	MG/KG	0.047	1	79.4	

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Table 5
T Range Validated Soil Data

AFIID	Location Description	LOC_ID	Sample ID	Sample Date	Analysis	Analyte	Units	MDL[1]	RL[2]	Result	Qualifiers[3]
MMR	T RANGE AREA 1E	SSTRNGA1E	TR1E0003GA	8/27/2010	SW6020	Tungsten	MG/KG	0.012	0.1	1.5	
MMR	T RANGE AREA 1E	SSTRNGA1E	TR1E0003GA	8/27/2010	SW8330	Nitroglycerin	UG/KG	548	1990	23500	
MMR	T RANGE AREA 1E	SSTRNGA1E	TR1E0003GB	8/30/2010	SW6010B	Antimony	MG/KG	0.16	3	0.7	J
MMR	T RANGE AREA 1E	SSTRNGA1E	TR1E0003GB	8/30/2010	SW6010B	Copper	MG/KG	0.1	1.2	60.7	
MMR	T RANGE AREA 1E	SSTRNGA1E	TR1E0003GB	8/30/2010	SW6010B	Lead	MG/KG	0.18	0.5	113	J
MMR	T RANGE AREA 1E	SSTRNGA1E	TR1E0003GB	8/30/2010	SW6010B	Zinc	MG/KG	0.047	1	25.3	
MMR	T RANGE AREA 1E	SSTRNGA1E	TR1E0003GB	8/30/2010	SW6020	Tungsten	MG/KG	0.012	0.1	1.1	J
MMR	T RANGE AREA 1E	SSTRNGA1E	TR1E0003GB	8/30/2010	SW8330	Nitroglycerin	UG/KG	548	1990	29700	
MMR	T RANGE AREA 1E	SSTRNGA1E	TR1E0003GC	8/30/2010	SW6010B	Antimony	MG/KG	0.16	3	2	J
MMR	T RANGE AREA 1E	SSTRNGA1E	TR1E0003GC	8/30/2010	SW6010B	Copper	MG/KG	0.1	1.2	53.9	
MMR	T RANGE AREA 1E	SSTRNGA1E	TR1E0003GC	8/30/2010	SW6010B	Lead	MG/KG	0.18	0.5	439	J
MMR	T RANGE AREA 1E	SSTRNGA1E	TR1E0003GC	8/30/2010	SW6010B	Zinc	MG/KG	0.047	1	27.1	
MMR	T RANGE AREA 1E	SSTRNGA1E	TR1E0003GC	8/30/2010	SW6020	Tungsten	MG/KG	0.023	0.2	1.4	J
MMR	T RANGE AREA 1E	SSTRNGA1E	TR1E0003GC	8/30/2010	SW8330	Nitroglycerin	UG/KG	538	1960	24000	
MMR	T RANGE AREA 1E	SSTRNGA1E	TR1E0003UA	8/27/2010	SW6010B	Antimony	MG/KG	0.16	3	0.52	J
MMR	T RANGE AREA 1E	SSTRNGA1E	TR1E0003UA	8/27/2010	SW6010B	Copper	MG/KG	0.1	1.2	31.6	
MMR	T RANGE AREA 1E	SSTRNGA1E	TR1E0003UA	8/27/2010	SW6010B	Lead	MG/KG	0.18	0.5	102	
MMR	T RANGE AREA 1E	SSTRNGA1E	TR1E0003UA	8/27/2010	SW6010B	Zinc	MG/KG	0.047	1	22.5	
MMR	T RANGE AREA 1E	SSTRNGA1E	TR1E0003UA	8/27/2010	SW6020	Tungsten	MG/KG	0.012	0.1	1.3	
MMR	T RANGE AREA 2A	SSTRNGA2A	TR2A0003GA	8/30/2010	SW6010B	Antimony	MG/KG	0.16	3	0.49	J
MMR	T RANGE AREA 2A	SSTRNGA2A	TR2A0003GA	8/30/2010	SW6010B	Copper	MG/KG	0.1	1.2	10.3	
MMR	T RANGE AREA 2A	SSTRNGA2A	TR2A0003GA	8/30/2010	SW6010B	Lead	MG/KG	0.17	0.5	29.3	J
MMR	T RANGE AREA 2A	SSTRNGA2A	TR2A0003GA	8/30/2010	SW6010B	Zinc	MG/KG	0.047	1	27.2	
MMR	T RANGE AREA 2A	SSTRNGA2A	TR2A0003GA	8/30/2010	SW6020	Tungsten	MG/KG	0.011	0.1	0.11	J
MMR	T RANGE AREA 2A	SSTRNGA2A	TR2A0003GB	8/30/2010	SW6010B	Antimony	MG/KG	0.16	2.9	0.28	J
MMR	T RANGE AREA 2A	SSTRNGA2A	TR2A0003GB	8/30/2010	SW6010B	Copper	MG/KG	0.1	1.2	10.4	
MMR	T RANGE AREA 2A	SSTRNGA2A	TR2A0003GB	8/30/2010	SW6010B	Lead	MG/KG	0.17	0.49	17	J
MMR	T RANGE AREA 2A	SSTRNGA2A	TR2A0003GB	8/30/2010	SW6010B	Zinc	MG/KG	0.046	0.98	23.5	
MMR	T RANGE AREA 2A	SSTRNGA2A	TR2A0003GB	8/30/2010	SW6020	Tungsten	MG/KG	0.011	0.098	0.38	J
MMR	T RANGE AREA 2A	SSTRNGA2A	TR2A0003GC	8/30/2010	SW6010B	Antimony	MG/KG	0.16	3	0.47	J
MMR	T RANGE AREA 2A	SSTRNGA2A	TR2A0003GC	8/30/2010	SW6010B	Copper	MG/KG	0.1	1.2	10.6	
MMR	T RANGE AREA 2A	SSTRNGA2A	TR2A0003GC	8/30/2010	SW6010B	Lead	MG/KG	0.17	0.49	14.4	J

Table 5
T Range Validated Soil Data

AFIID	Location Description	LOC_ID	Sample ID	Sample Date	Analysis	Analyte	Units	MDL[1]	RL[2]	Result	Qualifiers[3]
MMR	T RANGE AREA 2A	SSTRNGA2A	TR2A0003GC	8/30/2010	SW6010B	Zinc	MG/KG	0.046	0.99	25.8	
MMR	T RANGE AREA 2A	SSTRNGA2A	TR2A0003GC	8/30/2010	SW6020	Tungsten	MG/KG	0.011	0.099	0.099	J
MMR	T RANGE AREA 2A	SSTRNGA2A	TR2A0003UA	8/30/2010	SW6010B	Antimony	MG/KG	0.16	3	0.24	J
MMR	T RANGE AREA 2A	SSTRNGA2A	TR2A0003UA	8/30/2010	SW6010B	Copper	MG/KG	0.1	1.2	8.6	
MMR	T RANGE AREA 2A	SSTRNGA2A	TR2A0003UA	8/30/2010	SW6010B	Lead	MG/KG	0.18	0.5	30	J
MMR	T RANGE AREA 2A	SSTRNGA2A	TR2A0003UA	8/30/2010	SW6010B	Zinc	MG/KG	0.047	1	25.2	
MMR	T RANGE AREA 2A	SSTRNGA2A	TR2A0003UA	8/30/2010	SW6020	Tungsten	MG/KG	0.012	0.1	0.12	J

Notes:

[1] MDL = Method Detection Limit.

[2] RL = Laboratory Reporting Limit.

[3] Qualifiers: U = analyte was not detected above this value. J = value is estimated because it is below the laboratory reporting limit or due to limitations identified in the data validation. UJ = the analyte was not detected above this value and the value is estimated due to limitations identified in the data validation. R = value was rejected due to major problems identified in the data validation.

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Table 6
T Range Validated Lysimeter Data

AFIID	LOC_ID	Sample ID	Sample Date	Analysis	Analyte	Units	MDL[1]	RL[2]	Result	Qualifiers[3]
MMR	LYTR04	LYTR04	8/25/2010	SW6010B	Antimony	UG/L	3.6	60	ND	U
MMR	LYTR04	LYTR04	8/25/2010	SW6010B	Copper	UG/L	1.4	25	ND	U
MMR	LYTR04	LYTR04	8/25/2010	SW6010B	Lead	UG/L	3.2	10	ND	U
MMR	LYTR04	LYTR04	8/25/2010	SW6020	Tungsten	UG/L	0.3	2	ND	U
MMR	LYTR04	LYTR04	8/25/2010	SW8330	Nitroglycerin	UG/L	2.09	8.51	ND	U
MMR	LYTR07	LYTR07	8/26/2010	SW6010B	Antimony	UG/L	3.6	60	ND	U
MMR	LYTR07	LYTR07	8/26/2010	SW6010B	Copper	UG/L	1.4	25	1410	
MMR	LYTR07	LYTR07	8/26/2010	SW6010B	Lead	UG/L	3.2	10	5.9	J
MMR	LYTR07	LYTR07	8/26/2010	SW6020	Tungsten	UG/L	0.3	2	ND	U
MMR	LYTR07	LYTR07	8/26/2010	SW8330	Nitroglycerin	UG/L	2.33	9.52	ND	U
MMR	LYTR07A	LYTR07A	8/26/2010	SW6010B	Antimony	UG/L	3.6	60	ND	U
MMR	LYTR07A	LYTR07A	8/26/2010	SW6010B	Copper	UG/L	1.4	25	74.6	
MMR	LYTR07A	LYTR07A	8/26/2010	SW6010B	Lead	UG/L	3.2	10	ND	U
MMR	LYTR07A	LYTR07A	8/26/2010	SW6020	Tungsten	UG/L	0.3	2	ND	U
MMR	LYTR07A	LYTR07A	8/26/2010	SW8330	Nitroglycerin	UG/L	2.39	19.3	ND	UJ
MMR	LYTR07B	LYTR07B	8/25/2010	SW6010B	Antimony	UG/L	3.6	60	3.7	J
MMR	LYTR07B	LYTR07B	8/25/2010	SW6010B	Copper	UG/L	1.4	25	41.2	
MMR	LYTR07B	LYTR07B	8/25/2010	SW6010B	Lead	UG/L	3.2	10	ND	U
MMR	LYTR07B	LYTR07B	8/25/2010	SW6020	Tungsten	UG/L	0.3	2	ND	U
MMR	LYTR07B	LYTR07B	8/25/2010	SW8330	Nitroglycerin	UG/L	2.04	8.33	ND	U
MMR	LYTR07C	LYTR07C	8/27/2010	SW6010B	Antimony	UG/L	3.6	60	ND	U
MMR	LYTR07C	LYTR07C	8/27/2010	SW6010B	Copper	UG/L	1.4	25	29.5	
MMR	LYTR07C	LYTR07C	8/27/2010	SW6010B	Lead	UG/L	3.2	10	ND	U
MMR	LYTR07C	LYTR07C	8/27/2010	SW6020	Tungsten	UG/L	0.3	2	ND	U
MMR	LYTR07C	LYTR07C	8/27/2010	SW8330	Nitroglycerin	UG/L	2.51	10.3	ND	U
MMR	LYTR10	LYTR10	8/26/2010	SW6010B	Antimony	UG/L	3.6	60	ND	U
MMR	LYTR10	LYTR10	8/26/2010	SW6010B	Copper	UG/L	1.4	25	34.1	
MMR	LYTR10	LYTR10	8/26/2010	SW6010B	Lead	UG/L	3.2	10	ND	U
MMR	LYTR10	LYTR10	8/26/2010	SW6020	Tungsten	UG/L	0.3	2	ND	U
MMR	LYTR10	LYTR10	8/26/2010	SW8330	Nitroglycerin	UG/L	2.28	9.3	ND	U
MMR	LYTRFL04	LYTRFL04	8/25/2010	SW6010B	Antimony	UG/L	3.6	60	6.8	J
MMR	LYTRFL04	LYTRFL04	8/25/2010	SW6010B	Copper	UG/L	1.4	25	13.8	J
MMR	LYTRFL04	LYTRFL04	8/25/2010	SW6010B	Lead	UG/L	3.2	10	ND	U

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Table 6
T Range Validated Lysimeter Data

AFIID	LOC_ID	Sample ID	Sample Date	Analysis	Analyte	Units	MDL[1]	RL[2]	Result	Qualifiers[3]
MMR	LYTRFL04	LYTRFL04	8/25/2010	SW6020	Tungsten	UG/L	0.3	2	ND	U
MMR	LYTRFL04	LYTRFL04	8/25/2010	SW8330	Nitroglycerin	UG/L	2.23	9.09	ND	U
MMR	LYTRFL07	LYTRFL07	8/25/2010	SW6010B	Antimony	UG/L	3.6	60	ND	U
MMR	LYTRFL07	LYTRFL07	8/25/2010	SW6010B	Copper	UG/L	1.4	25	ND	U
MMR	LYTRFL07	LYTRFL07	8/25/2010	SW6010B	Lead	UG/L	3.2	10	ND	U
MMR	LYTRFL07	LYTRFL07	8/25/2010	SW6020	Tungsten	UG/L	0.3	2	ND	U
MMR	LYTRFL07	LYTRFL07	8/25/2010	SW8330	Nitroglycerin	UG/L	2.28	9.3	ND	U
MMR	LYTRFL10	LYTRFL10	8/25/2010	SW6010B	Antimony	UG/L	3.6	60	11.7	J
MMR	LYTRFL10	LYTRFL10	8/25/2010	SW6010B	Copper	UG/L	1.4	25	13.1	J
MMR	LYTRFL10	LYTRFL10	8/25/2010	SW6010B	Lead	UG/L	3.2	10	ND	U
MMR	LYTRFL10	LYTRFL10	8/25/2010	SW6020	Tungsten	UG/L	0.3	2	ND	U
MMR	LYTRFL10	LYTRFL10	8/25/2010	SW8330	Nitroglycerin	UG/L	2.28	9.3	ND	U
MMR	LYTRNG011	LYTR11A	10/8/2010	SW6010B	Antimony	UG/L	3.6	60	ND	U
MMR	LYTRNG011	LYTR11A	10/8/2010	SW6010B	Copper	UG/L	1.4	25	5.4	J
MMR	LYTRNG011	LYTR11A	10/8/2010	SW6010B	Lead	UG/L	3.2	10	3.3	J
MMR	LYTRNG011	LYTR11A	10/8/2010	SW6020	Tungsten	UG/L	0.3	2	ND	U
MMR	LYTRNG011	LYTR11A	10/8/2010	SW8330	Nitroglycerin	UG/L	0.96	3.92	ND	UJ
MMR	LYTRNG012	LYTR12A	10/8/2010	SW6010B	Antimony	UG/L	3.6	60	ND	U
MMR	LYTRNG012	LYTR12A	10/8/2010	SW6010B	Copper	UG/L	1.4	25	ND	U
MMR	LYTRNG012	LYTR12A	10/8/2010	SW6010B	Lead	UG/L	3.2	10	ND	U
MMR	LYTRNG012	LYTR12A	10/8/2010	SW6020	Tungsten	UG/L	0.3	2	ND	U
MMR	LYTRNG012	LYTR12A	10/8/2010	SW8330	Nitroglycerin	UG/L	1.02	7.5	ND	UJ
MMR	LYTRNG013	LYTR13A	10/8/2010	SW6010B	Antimony	UG/L	3.6	60	ND	U
MMR	LYTRNG013	LYTR13A	10/8/2010	SW6010B	Copper	UG/L	1.4	25	ND	U
MMR	LYTRNG013	LYTR13A	10/8/2010	SW6010B	Lead	UG/L	3.2	10	ND	U
MMR	LYTRNG013	LYTR13A	10/8/2010	SW6020	Tungsten	UG/L	0.3	2	ND	U
MMR	LYTRNG013	LYTR13A	10/8/2010	SW8330	Nitroglycerin	UG/L	0.92	41.8	ND	UJ

Notes:

[1] MDL = Method Detection Limit.

[2] RL = Laboratory Reporting Limit.

[3] Qualifiers: U = analyte was not detected above this value. J = value is estimated because it is below the laboratory reporting limit or due to limitations identified in the data validation. UJ = the analyte was not detected above this value and the value is estimated due to limitations identified in the data validation. R = value was rejected due to major problems identified in the data validation.

Table 7
T Range Validated Groundwater Data

AFIID	LOC_ID	Sample ID	Date	Analysis	Analyte	Units	MDL[1]	RL[2]	Result	Qualifiers[3]
MMR	MW-467S	MW-467S101310A	10/13/2010	SW6010B	Antimony	UG/L	3.6	60	ND	U
MMR	MW-467S	MW-467S101310A	10/13/2010	SW6010B	Copper	UG/L	1.4	25	ND	U
MMR	MW-467S	MW-467S101310A	10/13/2010	SW6010B	Lead	UG/L	3.2	10	ND	U
MMR	MW-467S	MW-467S101310A	10/13/2010	SW6010B	Zinc	UG/L	3.6	20	ND	U
MMR	MW-467S	MW-467S101310A	10/13/2010	SW6020	Tungsten	UG/L	0.3	2	ND	U
MMR	MW-467S	MW-467S101310A	10/13/2010	SW8330	Nitroglycerin	UG/L	0.98	4	ND	U
MMR	MW-489S	MW-489S102010	10/20/2010	SW6010B	Antimony	UG/L	3.6	60	ND	U
MMR	MW-489S	MW-489S102010	10/20/2010	SW6010B	Copper	UG/L	1.4	25	ND	U
MMR	MW-489S	MW-489S102010	10/20/2010	SW6010B	Lead	UG/L	3.2	10	ND	U
MMR	MW-489S	MW-489S102010	10/20/2010	SW6020	Tungsten	UG/L	0.3	2	ND	U
MMR	MW-489S	MW-489S102010	10/20/2010	SW8330	Nitroglycerin	UG/L	0.98	4	ND	U

Notes:
[1] MDL = Method Detection Limit.
[2] RL = Laboratory Reporting Limit.
[3] Qualifiers: U = analyte was not detected above this value. J = value is estimated because it is below the laboratory reporting limit or due to limitations identified in the data validation. UJ = the analyte was not detected above this value and the value is estimated due to limitations identified in the data validation. R = value was rejected due to major problems identified in the data validation.

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JULIET, KILO, AND TANGO RANGES
2011 ENVIRONMENTAL SAMPLING AND ANALYSIS REPORT

Sampling May 2011 through October 2011

1.0 INTRODUCTION

Juliet, Kilo, and Tango Ranges at Camp Edwards are 25-meter small arms ranges (SARs) currently used for marksmanship training using lead ammunition under a pilot test program approved by the US Environmental Protection Agency (EPA) and the Environmental Management Commission (EMC). The pilot test program is intended to assess the STAPP bullet containment systems installed on these three ranges and determine if the ranges can be used for live firing with lead ammunition while protecting the environment. The pilot test program has been extended at all three ranges by EPA and EMC until the end of calendar year 2011. Figure 1 shows the locations of J, K, and T Ranges within Camp Edwards.

As part of the pilot test approval, and in accordance with the conditions established by the EMC and the EPA for the Massachusetts Army National Guard (MANG) to fire lead ammunition, these ranges are operated and maintained as outlined in range-specific Best Management Practices and Operations, Maintenance, and Monitoring Plans (OMMPs). The OMMPs include a program of periodic sampling of soil, pore water, and groundwater. The samples are analyzed for range-related analytes including select metals that are commonly used in ammunition, tungsten, and the propellant nitroglycerine. Soil samples and pore water samples are also analyzed for pH which is an important parameter for determining the mobility of certain metals in the environment. The goal of this monitoring program is to determine when routine maintenance activities are needed to promote range sustainability and protect the environment.

This report summarizes the sampling program that was conducted by the MANG in 2011 as prescribed in the respective OMMPs for J, K, and T Ranges.

2.0 RANGE USE SUMMARY

J Range has been used as a SAR since the 1980s. Investigations of soil and groundwater were completed by the Impact Area Groundwater Study Program (IAGWSP) and the Final Juliet (J) Range Soil and Groundwater Investigation Report was completed in September 2008. Levels of nitroglycerine and lead that indicated deposition from range use were detected in soil. However, these analytes were not detected in groundwater. The MANG decided to remove surface soils from the range and regrade it in 2008 and a STAPP bullet collection system was installed. The range floor was completely re-graded and reconstructed to improve drainage in 2010. Three pan lysimeters were installed on the range in 2010 to monitor pore water percolating through the soil. The pilot test period commenced on J Range in 2009. Approximately 50,000 bullets were fired into the STAPP system on the range from 2009 to 2010. An additional 60,000 bullets (approximately) were fired in 2011. This report summarizes the second and third rounds of operational samples collected under the OMMP at J Range.

K Range has been used as a SAR since the 1980s. Investigations of soil and groundwater were completed by the IAGWSP and the Final Kilo (K) Range Soil and Groundwater Investigation Report was completed in September 2008. Levels of nitroglycerine and lead that indicated deposition from range use were detected in soil. However, these analytes were not detected in groundwater. The MANG regraded the range and installed a STAPP bullet collection system in 2008. The range floor was completely re-graded and reconstructed to improve drainage in 2010. Three pan lysimeters were installed on the range in 2010 to monitor pore water percolating through the soil. The pilot test period commenced on K Range in 2009. Approximately 90,000 bullets were fired into the STAPP system on the range from 2009 to 2010. An additional 125,000 bullets (approximately) were fired in 2011. This report summarizes the second and third rounds of operational samples collected under the OMMP at K Range.

T Range has been used as a SAR since the 1980s. Investigations of soil and groundwater were completed by the IAGWSP and the Draft Final T Range Soil and Groundwater Investigation Report was completed by the IAGWSP in June 2007. Levels of nitroglycerine and lead were detected in soil that indicated deposition from range use. However, these analytes were not detected in groundwater. The MANG re-graded surface soils from the mounded firing line, in effect raising the 25-meter firing line and improving the angle of fire into the STAPP system. The area between the firing line and the new berm were not excavated or regraded. The STAPP bullet collection system was installed in 2006. Several suction lysimeters were installed in 2007 to monitor pore water percolating through the soil for tungsten. These were removed after sampling in 2010 because of concerns with the quality and representativeness of the samples. Three pan lysimeters were installed on the range in 2010. The pilot test period commenced in 2008. Operational samples were first collected under the OMMP in 2008. Approximately 254,000 bullets were fired on the range from the commencement of the pilot test through 2010. An additional 37,000 bullets were fired in 2011.

3.0 OMMP MONITORING REQUIREMENTS

3.1 Surface Soil

The soil sampling at J, K, and T Ranges includes multi-increment sampling (MIS) from 0 to 3 inches depth from 6 sample areas on each range (see Attachment 1,

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Figures 1, 2, and 3). The sample areas are laid out in strips across the width of the ranges from the firing lines to the backstop berms so that the impact of deposition at the firing lines, the target areas, and the areas in between could be separately quantified.

Soil samples were collected from all three ranges in May and October 2011. The specific sample collection protocol is described in the attached "Small Arms Range Sampling and Analysis Data Report – July 2011" (Attachment 1) and "Small Arms Range Sampling and Analysis Data Report – December 2011" (Attachment 2) prepared by Tetra Tech EC, the contractor who completed the sampling. Soil samples were analyzed for antimony, copper, lead, zinc, tungsten, and nitroglycerine. Soil sampling locations are shown in Attachments 1 and 2, Figures 1, 2, and 3.

3.2 Pore Water

Pore water samples were collected from pan lysimeters installed on J, K, and T Ranges in May and October 2011. All pan lysimeters are installed approximately 2 feet below the ground surface. All pore water samples were analyzed for antimony, copper, lead, tungsten, and nitroglycerine. The locations of the lysimeters are shown on Attachments 1 and 2, Figures 1, 2, and 3.

During the October 2011 sampling round, pH readings were taken from the lysimeters for the first time. Measuring the pH of the pore water provides some indication of the effectiveness of the lime additions on the range floor. The pH readings ranged from 7.0 to 9.0 as summarized in the table below. Three of the lysimeters did not have enough water in them for readings to be taken.

LOCID	Sample_ID	Sample_Date	Analyte	Result
LYJRNG001	LYJRNG001_OCT11UA	10/12/2011	pH	8.6
LYJRNG002	LYJRNG002_OCT11UA	10/12/2011	pH	7.6
LYJRNG003	LYJRNG003_OCT11UA	10/11/2011	pH	8.0
LYKRNG001	LYKRNG001_OCT11UA	10/21/2011	pH	No water
LYKRNG002	LYKRNG002_OCT11UA	10/12/2011	pH	7.6
LYKRNG003	LYKRNG003_OCT11UA	10/12/2011	pH	9.0
LYKRNG004	LYKRNG004_OCT11UA	10/12/2011	pH	No water
LYTRNG011	LYTR011_OCT11UA	10/11/2011	pH	7.0
LYTRNG012	LYTR012_OCT11UA	10/11/2011	pH	No water
LYTRNG013	LYTR013_OCT11UA	10/11/2011	pH	8.1

3.3 Groundwater

Groundwater monitoring well locations are shown on Attachments 1 and 2, Figures 1, 2, and 3.

Groundwater samples were collected in May and October 2011. Samples were analyzed for antimony, lead, copper, zinc, tungsten, and nitroglycerine.

3.4 STAPP System Water

3.4.1 Tango Range

A total of 2,465 gallons of water were removed from the Tango Range STAPP system during training year (TY) 2011. No analytical characterization of the water was required by the receiving facility during 2011 because the water was already previously characterized. However, at the request of EPA, samples were collected and analyzed from the T Range STAPP system in October 2011. The results are included in Attachment 2 - Small Arms Range Sampling and Analysis Data Report – December 2011, Table 10. Samples of the STAPP water were also collected in the spring of 2011. The results of those analyses were provided previously under separate cover.

3.4.2 Juliet & Kilo Ranges

A total of 815 gallons was removed from the J Range STAPP system and a total of 1,545 gallons was removed from the K Range STAPP system. No analytical characterization of the water was required by the receiving facility during 2011 because the water was already previously characterized. However, at the request of EPA, samples were collected and analyzed from the J and K Range STAPP systems in October 2011. The results are included in Attachment 2 - Small Arms Range Sampling and Analysis Data Report – December 2011, Table 10. Samples of the STAPP water were also collected in the spring of 2011. The results of those analyses were provided previously under separate cover.

4.0 SUMMARY OF LABORATORY RESULTS

Laboratory data from the analyses of soil, pore water, groundwater, and STAPP water samples collected at the three ranges during this reporting period are summarized in the Small Arms Ranges Sampling and Analysis Data Reports which are provided as Attachments 1 and 2.

5.0 COMPARISON TO OMMP INTERIM ACTION LEVELS

The OMMPs for the respective ranges list interim action levels for soil, pore water, and groundwater that trigger responses at different concentrations. Action levels have been assigned for lead, antimony, and nitroglycerine in soil, pore water, and groundwater. Action levels for copper have also been assigned for pore water and groundwater (but not for soil). The action levels for soil, pore water, and groundwater are summarized on Figure 2. As presented in the OMMPs, the interim action levels were assigned for only the initial year of range operation. At all three ranges that initial year has passed, however, since the ranges continue to operate under the pilot test program, the interim action levels continue to be used as a point of comparison for the laboratory results.

5.1 Soil

At J Range, the level 2 interim action level for nitroglycerine in soil was exceeded at Area 1 during both the May and October sampling events. No other area on J Range had any exceedences. Figures 3 and 4 summarize the soil sampling results for nitroglycerine and lead on J Range in May and October respectively.

At K Range, the level 1 interim action level for nitroglycerine in soil was exceeded in soil sample Area 1 and Area 5 in May. In October, the level 2 interim action level was exceeded in Area 1. There were no other exceedences at that time. Figure 5 and 6 summarize the soil sampling results for nitroglycerine and lead on K Range in May and October respectively.

At T Range the level 1 interim action level for nitroglycerine in soil was exceeded at sample Area 1C and the level 2 interim action level was exceeded at areas 1A, 1D, and 1E in May. This pattern was repeated in the October sampling. Figures 7 and 8 summarize the soil sampling results for nitroglycerine and lead on T Range in May and October respectively.

5.2 Pore Water

No interim action levels were exceeded in the lysimeters at J Range.

No interim action levels were exceeded in the lysimeters at K Range.

No interim action levels were exceeded in the lysimeters at T Range.

5.3 Groundwater

No interim action levels were exceeded in the groundwater monitoring wells at J Range.

No interim action levels were exceeded in the groundwater monitoring wells at K Range.

No interim action levels were exceeded in the groundwater monitoring wells at T Range.

6.0 COMPARISON WITH PREVIOUS SAMPLING RESULTS

6.1 Soil

Soil sampling on J and K Ranges started in October 2010. That was the first sample collection since reconstruction of the ranges including complete replacement of the range floors. Additional samples have been collected in May 2011 and October 2011 using the same protocols. At T Range, soil samples were collected in February 2008, October 2010, May 2011, and October 2011.

The following is a brief comparison of nitroglycerine and lead concentrations over time as these are the two primary analytes of interest.

Lead concentrations at J range have remained steady over the three sample rounds conducted. Average lead concentrations, using all 12 soil samples collected, has been 44 ppm, 53 ppm, and 50 ppm.

Lead concentrations at K range have remained steady over the three sample rounds conducted. Average lead concentrations, using all 12 soil samples collected, all been in 24, 23 ppm, and 27 ppm. These values are similar to background concentrations.

Lead concentrations at T Range should be considered in two parts. The area of the range that was reworked during construction in 2008 is represented by sample Areas 1A and 1B. The lead concentrations in Areas 1A and 1B remain similar to background concentrations. The downrange area that has remained mostly undisturbed for many years of range use is represented by areas 1C, 1D, and 1E. Lead concentrations in Areas 1C, 1D, and 1E have, on average decreased somewhat since 2010.

Average lead concentrations, ppm			
	Oct-10	May-11	Oct-11
J Range	44	53	50
K Range	24	23	27
T Range	212	165	207

Nitroglycerine concentrations have increased at all three ranges. This is probably due, at least in part, to the sample collection occurring within days after a training event on the ranges when fresh propellants were deposited on the range.

Average Nitro concentrations, ppb			
	Oct-10	May-11	Oct-11
J Range	no calc*	3702	4268
K Range	no calc*	3773	6781
T Range	14,794	10,312	12,705

*no calc= the range-wide average could not be calculated because many of the analytical results were below the reporting limit of the method

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6.2 Pore Water

The pore water lysimeters at J, K, and T Ranges have been sampled three times: October 2010, May 2011, and October 2011. Lead, copper and zinc are the only analytes that have been detected in more than one sampling event but the detected concentrations have been estimated below the reporting limit each time. No significant trends have been observed at any location.

6.3 Groundwater

Copper and zinc have been detected in groundwater samples from all three ranges. However, most concentrations are estimated concentrations below the reporting limit of the analyses. No trends have been observed in any of the wells.

At T Range, a sample collected from MW-467S in March 2010 contained elevated levels of several metals including lead. This well has been resampled and analyzed for metals 3 times since then and those metals have not been detected again. This indicates that the one-time detection of lead and other metals in MW-467S was anomalous and not representative of actual conditions in the groundwater aquifer. It is suspected that interference caused by sediment containing naturally occurring metals in the unfiltered sample was the cause of the anomalous levels.

7.0 REPEATABILITY OF REPLICATE SOIL SAMPLES

Repeatability of a sampling program is assessed through the collection and analysis of replicate samples from the same sample area. The Relative Standard Deviation (RSD) of the replicates is calculated and compared to a quality goal. The RSD= the standard deviation of the three replicate results divided by the average of the three results expressed as a percentage. In Appendix C attached to EPA's May 3 2011 letter, EPA indicates a preference for RSDs of 25% or less for sampling at J, K, and T Ranges.

Replicate samples are collected from Area 1, Area 3, and Area 5 at J and K Ranges and from Area 1A, 1B, 1C, 1D, and 1E at T range. The table below summarizes the RSDs calculated for lead and nitroglycerine May and October 2011. Concentrations of other soil analytes are generally not detected or at low concentrations so the RSDs of those analytes were not calculated.

Relative Percent Differences in Replicate Samples at
J, K, and T Ranges, 2011

Range	Sample Area	May 2011 RPD – Lead	May 2011 RPD – Nitro		October 2011 RPD – Lead	October 2011 RPD – Nitro

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		(%)	(%)		(%)	(%)
J	Area 1	17	23		16	21
	Area 3	67*	27*		34*	17
	Area 5	14	20		25	8
K	Area 1	5	13		11	26
	Area 3	2	14		7	9
	Area 5	4	48*		5	2
T	Area 1A	5	16		3	17
	Area 1B	14	24		11	12
	Area 1C	10	27		5	7
	Area 1D	44*	27		16	18
	Area 1E	18	14		15	4
Overall average RPD		18	23		14	13

*Despite RSD greater than 25%, all concentrations were below the interim action levels.

The RSDs for lead range from 2% to 67% with an OMMP program-wide average of 18% in May 2011 and 14% in October 2011. This indicates a successful sampling program although there are some outliers.

Note that all lead results were far below the interim action levels specified in the OMMPs, even for the samples with the worst repeatability. Specifically, the highest lead detection on any range was 522 ppm which is less than 12% of the level 1 interim action level (4535 ppm). All data have been adequate for decision making under the OMMPs and re-sampling in the areas where repeatability was poor is not needed.

The RSDs for nitroglycerine range of 2 to 48% and an average of 23% in May 2011 and 13% in October 2011. This indicates a successful sampling program although there are some outliers. This good correlation indicates that the actual concentration in the soil is likely to be within the range of the three detected values. All data have been adequate for decision making under the OMMPs and re-sampling in the areas where repeatability was poor is not needed.

8.0 FURTHER ACTION

Soil, pore water, and groundwater samples will be collected again in October 2012. The scope of the sampling at that time will be dictated by the new Combined J, K, and T Ranges OMMP that is currently being drafted. The results of the environmental monitoring conducted to date will help to inform the decisions made developing the scope of work in that document.

T Range will most likely be converted to a copper-only range using the new M855A1 bullet. When that occurs, T Range monitoring will no longer be conducted under the current T Range OMMP.

FIGURES

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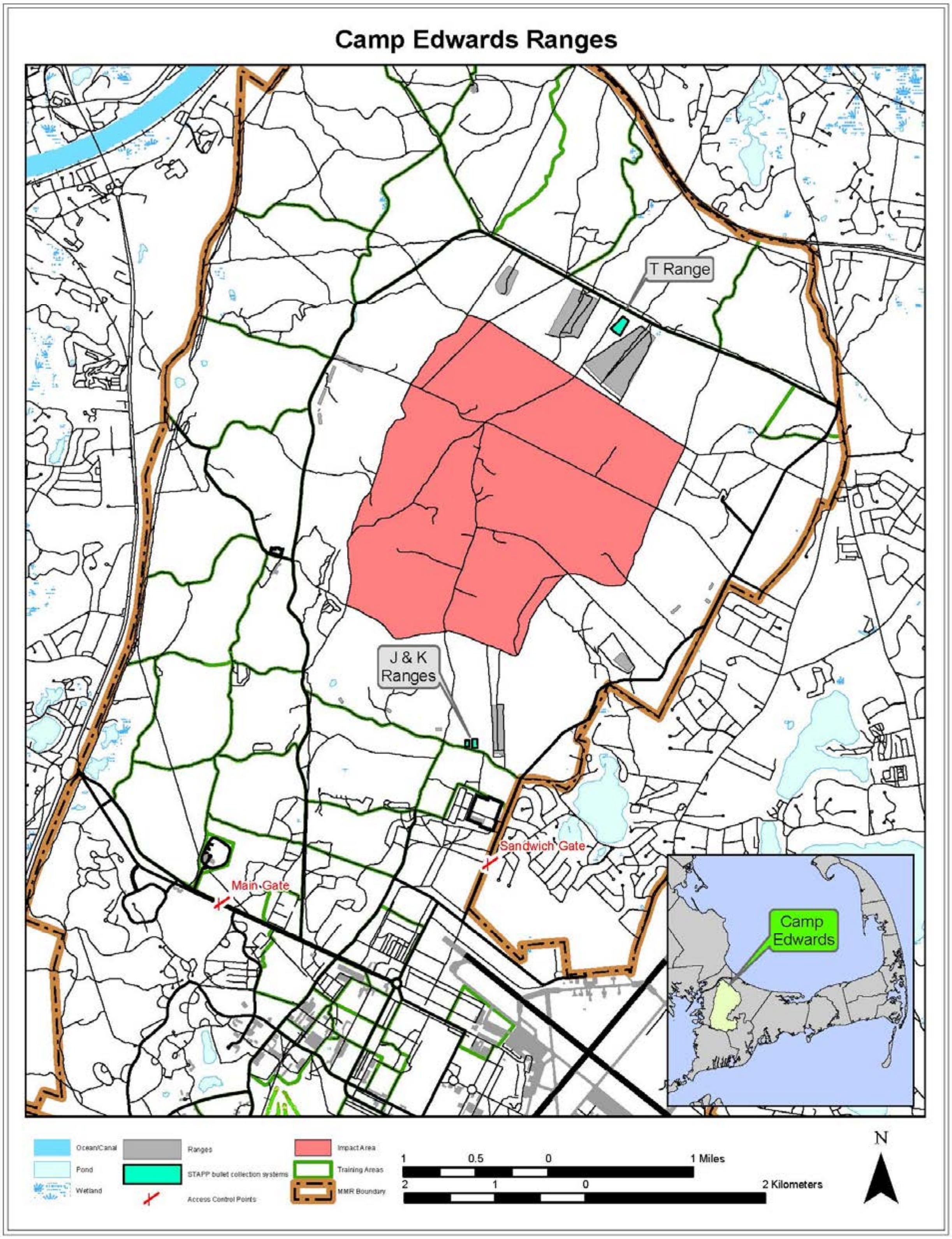
Camp Edwards Ranges
T Range
J & K Ranges
Sandwich Gate
Main Gate
Camp Edwards
Ocean/Canal
Pond
Wetland
Ranges
STAPP bullet collection systems
Access Control Points
Impact Area
Training Areas
MMR Boundary
1 0.5 0 1 Miles
2 1 0 2 Kilometers
N

Figure 2
OMMP Interim Action Levels

Table 4-1. Interim Surface Soil Action Levels for the Initial Year of Fire Operations on Juliet Range

Analyte	Level 1 Resampling and Validation[1]	Level 2 Focused Reassessment[2]
Lead	4,535 mg/Kg	9,070 mg/Kg
Antimony	1,750 mg/Kg	3,500 mg/Kg
Nitroglycerin	5 mg/Kg	10 mg/Kg

Table 4-2. Interim Soil-Pore Water Action Levels for the Initial Year of Fire Operations on Juliet Range

Analyte	Level 1 Sampling and Validation[1]	Level 2 Focused Reassessment[2]	Level 3 Range Maintenance[3]
Lead	10 ug/L	15 ug/L	30 ug/L
Copper	867 ug/L	1,300 ug/L	2,600 ug/L
Antimony	4.0 ug/L	6.0 ug/L	12 ug/L
Nitroglycerin	3.2 ug/L	4.8 ug/L	9.6 ug/L

Table 4-3. Interim Groundwater Action Levels for the Initial Year of Fire Operations on Juliet Range

Analyte	Level 1 Sampling and Validation[1]	Level 2 Focused Reassessment[2]	Level 3 Cease Fire and Maintenance Action[3]
Lead	5.0 ug/L	7.5 ug/L	15 ug/L
Copper	434 ug/L	650 ug/L	1,300 ug/L
Antimony	2.0 ug/L	3.0 ug/L	6.0 ug/L
Nitroglycerin	1.6 ug/L	2.4 ug/L	4.8 ug/L

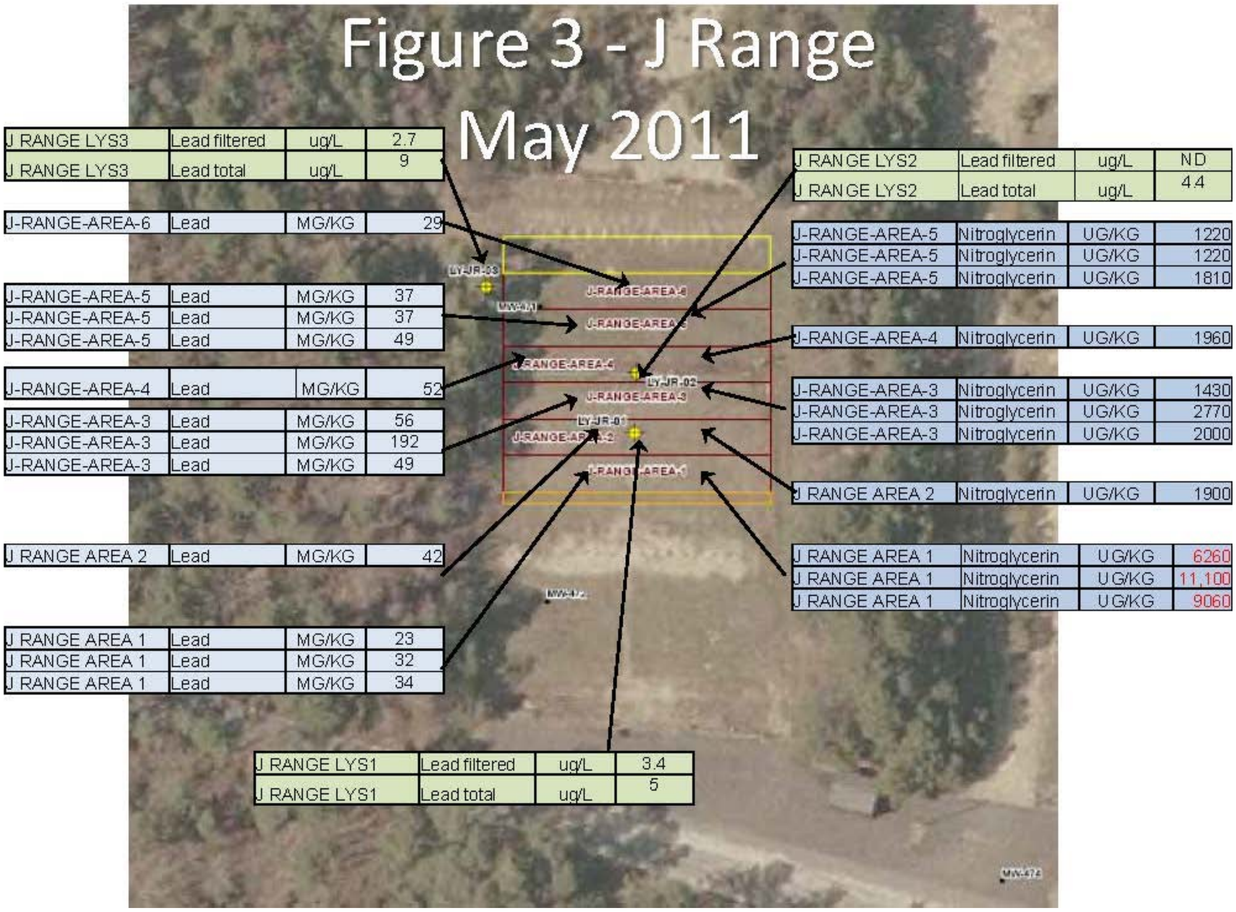
Figure 3 - J Range
May 2011
J RANGE LYS3 | Lead filtered | ug/L | 2.7
J RANGE LYS3 | Lead total | ug/L | 9
J-RANGE-AREA-6 | Lead | MG/KG | 29
J-RANGE-AREA-5 | Lead | MG/KG | 37
J-RANGE-AREA-5 | Lead | MG/KG | 37
J-RANGE-AREA-5 | Lead | MG/KG | 49
J-RANGE-AREA-4 | Lead | MG/KG | 52
J-RANGE-AREA-3 | Lead | MG/KG | 56
J-RANGE-AREA-3 | Lead | MG/KG | 192
J-RANGE-AREA-3 | Lead | MG/KG | 49
J RANGE AREA 2 | Lead | MG/KG | 42
J RANGE AREA 1 | Lead | MG/KG | 23
J RANGE AREA 1 | Lead | MG/KG | 32
J RANGE AREA 1 | Lead | MG/KG | 34
J RANGE LYS1 | Lead filtered | ug/L | 3.4
J RANGE LYS1 | Lead total | ug/L | 5
J RANGE LYS2 | Lead filtered | ug/L | ND
J RANGE LYS2 | Lead total | ug/L | 4.4
J-RANGE-AREA-5 | Nitroglycerin | UG/KG | 1220
J-RANGE-AREA-5 | Nitroglycerin | UG/KG | 1220
J-RANGE-AREA-5 | Nitroglycerin | UG/KG | 1810
J-RANGE-AREA-4 | Nitroglycerin | UG/KG | 1960
J-RANGE-AREA-3 | Nitroglycerin | UG/KG | 1430
J-RANGE-AREA-3 | Nitroglycerin | UG/KG | 2770
J-RANGE-AREA-3 | Nitroglycerin | UG/KG | 2000
J RANGE AREA 2 | Nitroglycerin | UG/KG | 1900
J RANGE AREA 1 | Nitroglycerin | UG/KG | 6260
J RANGE AREA 1 | Nitroglycerin | UG/KG | 11,100
J RANGE AREA 1 | Nitroglycerin | UG/KG | 9060
LY-JR-03
LY-JR-02
LY-JR-01

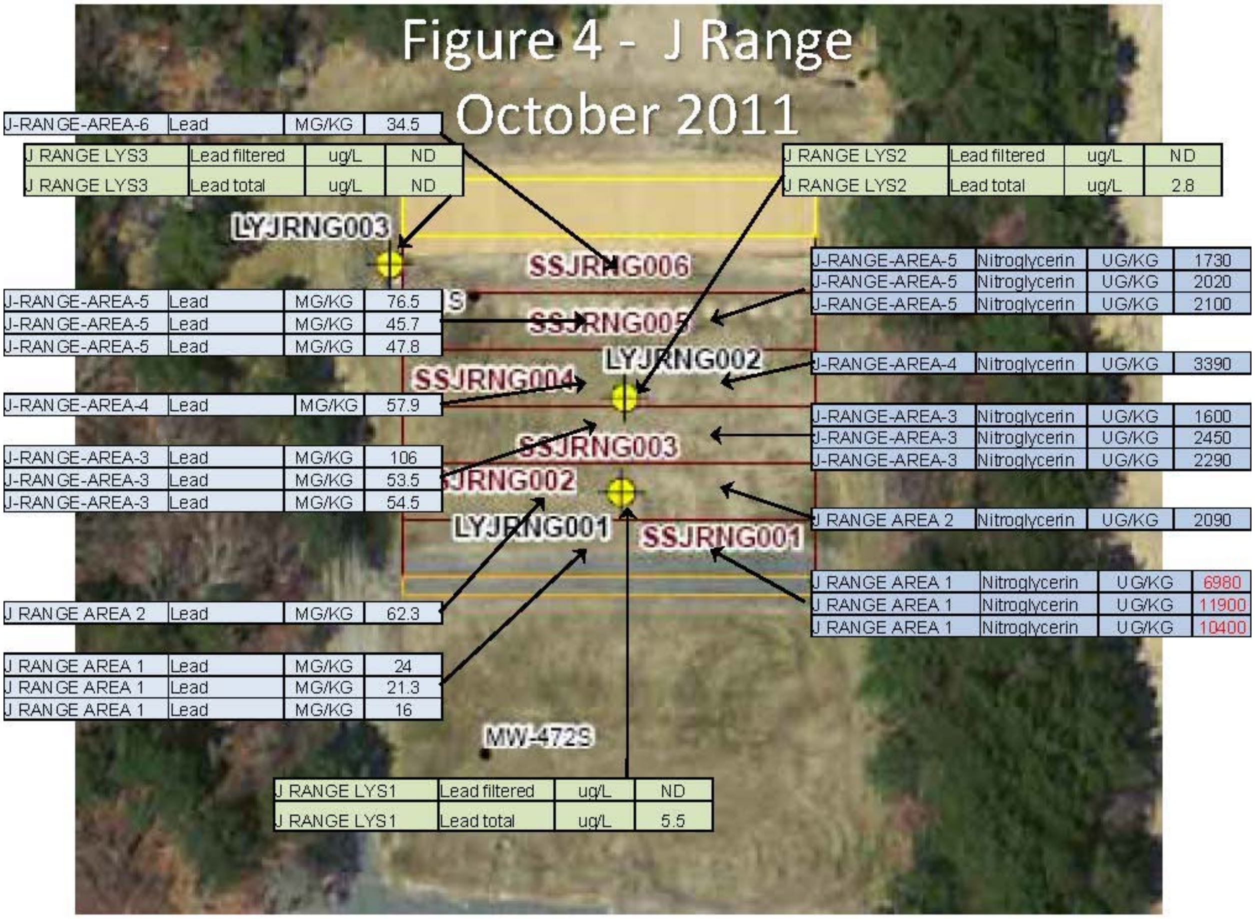
Figure 4 - J Range
October 2011
J-RANGE-AREA-6 Lead MG/KG 34.5
J RANGE LYS3 Lead filtered ug/L ND
J RANGE LYS3 Lead total ug/L ND
J RANGE LYS2 Lead filtered ug/L ND
J RANGE LYS2 Lead total ug/L 2.8
LYJRNG003
SSJRNG006
J-RANGE-AREA-5 Nitroglycerin UG/KG 1730
J-RANGE-AREA-5 Nitroglycerin UG/KG 2020
J-RANGE-AREA-5 Nitroglycerin UG/KG 2100
J-RANGE-AREA-5 Lead MG/KG 76.5
J-RANGE-AREA-5 Lead MG/KG 45.7
J-RANGE-AREA-5 Lead MG/KG 47.8
SSJRNG005
LYJRNG002
J-RANGE-AREA-4 Nitroglycerin UG/KG 3390
SSJRNG004
J-RANGE-AREA-4 Lead MG/KG 57.9
J-RANGE-AREA-3 Nitroglycerin UG/KG 1600
J-RANGE-AREA-3 Nitroglycerin UG/KG 2450
J-RANGE-AREA-3 Nitroglycerin UG/KG 2290
SSJRNG003
J-RANGE-AREA-3 Lead MG/KG 106
J-RANGE-AREA-3 Lead MG/KG 53.5
J-RANGE-AREA-3 Lead MG/KG 54.5
JRNG002
J RANGE AREA 2 Nitroglycerin UG/KG 2090
LYJRNG001
SSJRNG001
J RANGE AREA 1 Nitroglycerin UG/KG 6980
J RANGE AREA 1 Nitroglycerin UG/KG 11900
J RANGE AREA 1 Nitroglycerin UG/KG 10400
J RANGE AREA 2 Lead MG/KG 62.3
J RANGE AREA 1 Lead MG/KG 24
J RANGE AREA 1 Lead MG/KG 21.3
J RANGE AREA 1 Lead MG/KG 16
MW-472S
J RANGE LYS1 Lead filtered ug/L ND
J RANGE LYS1 Lead total ug/L 5.5

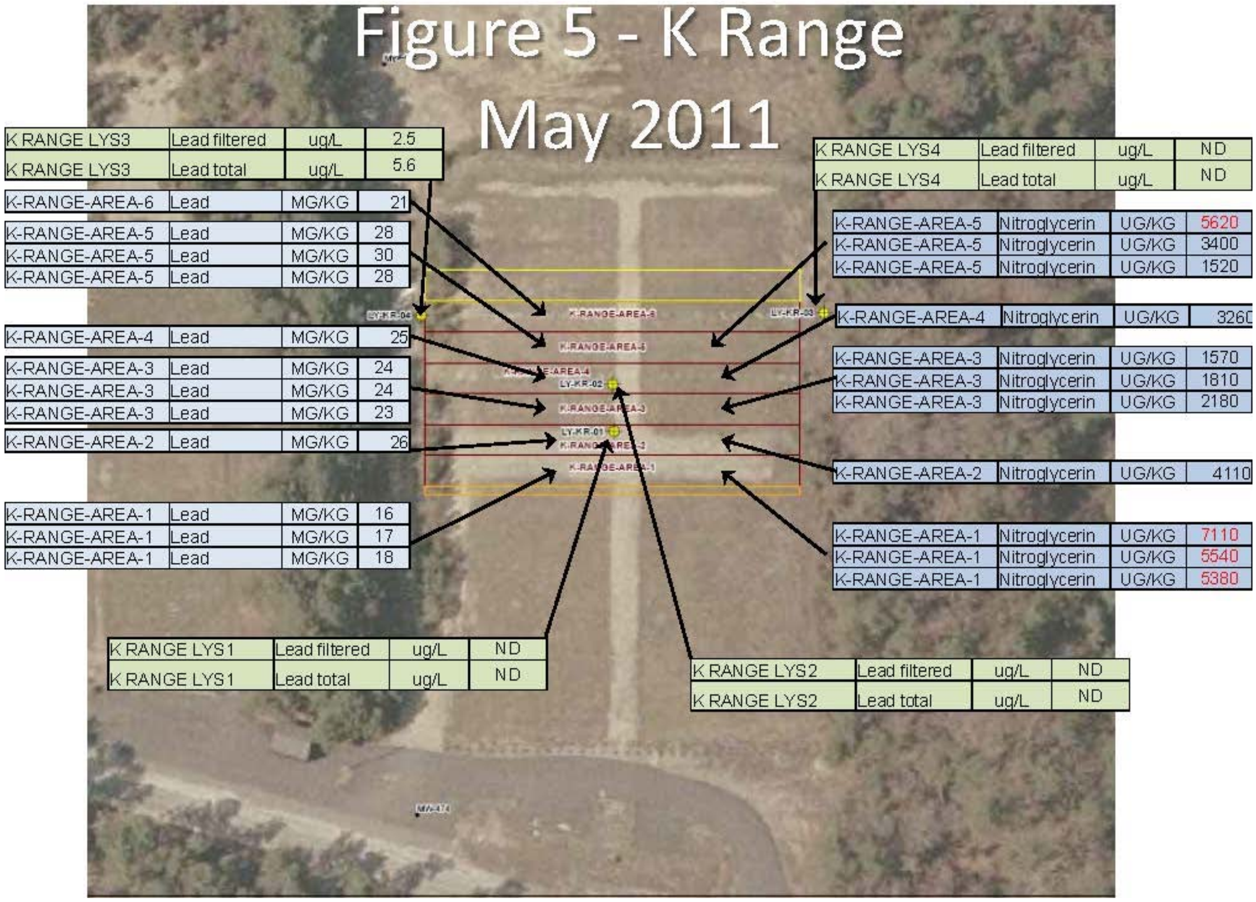
Figure 5 - K Range
May 2011
K RANGE LYS3 Lead filtered ug/L 2.5
K RANGE LYS3 Lead total ug/L 5.6
K-RANGE-AREA-6 Lead MG/KG 21
K-RANGE-AREA-5 Lead MG/KG 28
K-RANGE-AREA-5 Lead MG/KG 30
K-RANGE-AREA-5 Lead MG/KG 28
K-RANGE-AREA-4 Lead MG/KG 25
K-RANGE-AREA-3 Lead MG/KG 24
K-RANGE-AREA-3 Lead MG/KG 24
K-RANGE-AREA-3 Lead MG/KG 23
K-RANGE-AREA-2 Lead MG/KG 26
K-RANGE-AREA-1 Lead MG/KG 16
K-RANGE-AREA-1 Lead MG/KG 17
K-RANGE-AREA-1 Lead MG/KG 18
K RANGE LYS1 Lead filtered ug/L ND
K RANGE LYS1 Lead total ug/L ND
K RANGE LYS4 Lead filtered ug/L ND
K RANGE LYS4 Lead total ug/L ND
K-RANGE-AREA-5 Nitroglycerin UG/KG 5620
K-RANGE-AREA-5 Nitroglycerin UG/KG 3400
K-RANGE-AREA-5 Nitroglycerin UG/KG 1520
K-RANGE-AREA-4 Nitroglycerin UG/KG 3260
K-RANGE-AREA-3 Nitroglycerin UG/KG 1570
K-RANGE-AREA-3 Nitroglycerin UG/KG 1810
K-RANGE-AREA-3 Nitroglycerin UG/KG 2180
K-RANGE-AREA-2 Nitroglycerin UG/KG 4110
K-RANGE-AREA-1 Nitroglycerin UG/KG 7110
K-RANGE-AREA-1 Nitroglycerin UG/KG 5540
K-RANGE-AREA-1 Nitroglycerin UG/KG 5380
K RANGE LYS2 Lead filtered ug/L ND
K RANGE LYS2 Lead total ug/L ND

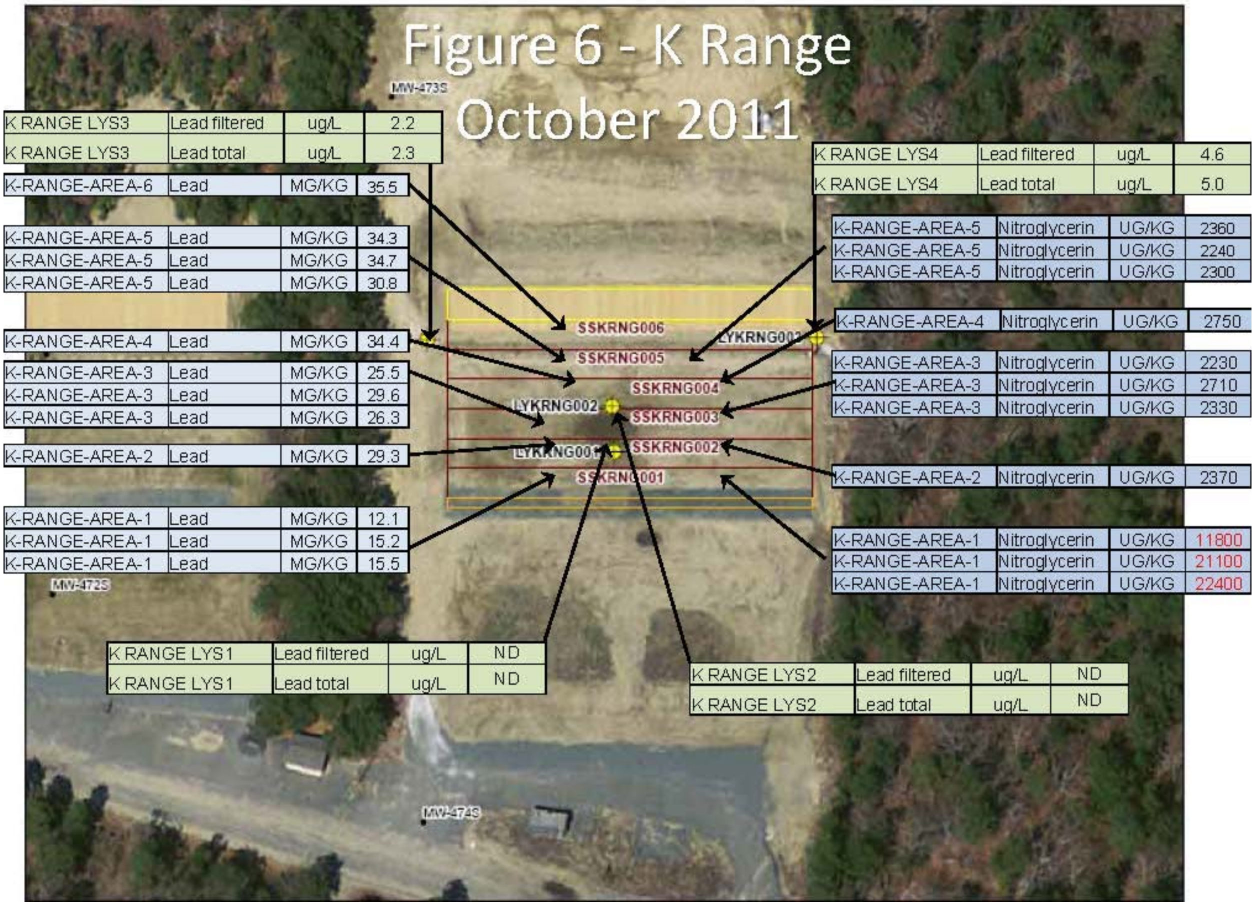
Figure 6 - K Range
October 2011
MW-473S
K RANGE LYS3 | Lead filtered | ug/L | 2.2
K RANGE LYS3 | Lead total | ug/L | 2.3
K-RANGE-AREA-6 | Lead | MG/KG | 35.5
K-RANGE-AREA-5 | Lead | MG/KG | 34.3
K-RANGE-AREA-5 | Lead | MG/KG | 34.7
K-RANGE-AREA-5 | Lead | MG/KG | 30.8
K-RANGE-AREA-4 | Lead | MG/KG | 34.4
K-RANGE-AREA-3 | Lead | MG/KG | 25.5
K-RANGE-AREA-3 | Lead | MG/KG | 29.6
K-RANGE-AREA-3 | Lead | MG/KG | 26.3
K-RANGE-AREA-2 | Lead | MG/KG | 29.3
K-RANGE-AREA-1 | Lead | MG/KG | 12.1
K-RANGE-AREA-1 | Lead | MG/KG | 15.2
K-RANGE-AREA-1 | Lead | MG/KG | 15.5
MW-472S
K RANGE LYS4 | Lead filtered | ug/L | 4.6
K RANGE LYS4 | Lead total | ug/L | 5.0
K-RANGE-AREA-5 | Nitroglycerin | UG/KG | 2360
K-RANGE-AREA-5 | Nitroglycerin | UG/KG | 2240
K-RANGE-AREA-5 | Nitroglycerin | UG/KG | 2300
K-RANGE-AREA-4 | Nitroglycerin | UG/KG | 2750
K-RANGE-AREA-3 | Nitroglycerin | UG/KG | 2230
K-RANGE-AREA-3 | Nitroglycerin | UG/KG | 2710
K-RANGE-AREA-3 | Nitroglycerin | UG/KG | 2330
K-RANGE-AREA-2 | Nitroglycerin | UG/KG | 2370
K-RANGE-AREA-1 | Nitroglycerin | UG/KG | 11800
K-RANGE-AREA-1 | Nitroglycerin | UG/KG | 21100
K-RANGE-AREA-1 | Nitroglycerin | UG/KG | 22400
SSKRNG006
SSKRNG005
SSKRNG004
SSKRNG003
SSKRNG002
SSKRNG001
LYKRNG002
LYKRNG001
K RANGE LYS1 | Lead filtered | ug/L | ND
K RANGE LYS1 | Lead total | ug/L | ND
K RANGE LYS2 | Lead filtered | ug/L | ND
K RANGE LYS2 | Lead total | ug/L | ND
MW-474S

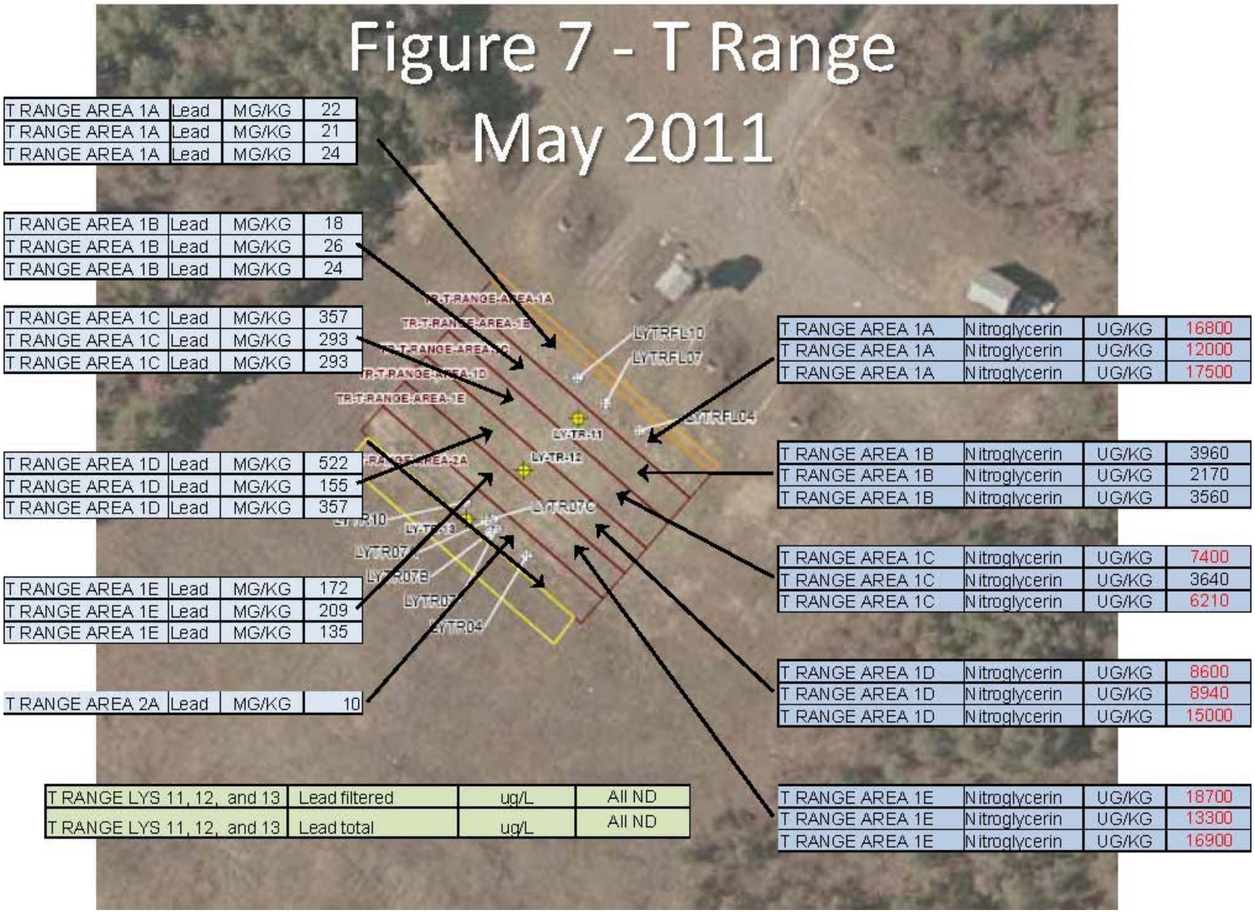
Figure 7 - T Range
May 2011
T RANGE AREA 1A | Lead | MG/KG | 22
T RANGE AREA 1A | Lead | MG/KG | 21
T RANGE AREA 1A | Lead | MG/KG | 24
T RANGE AREA 1B | Lead | MG/KG | 18
T RANGE AREA 1B | Lead | MG/KG | 26
T RANGE AREA 1B | Lead | MG/KG | 24
T RANGE AREA 1C | Lead | MG/KG | 357
T RANGE AREA 1C | Lead | MG/KG | 293
T RANGE AREA 1C | Lead | MG/KG | 293
T RANGE AREA 1D | Lead | MG/KG | 522
T RANGE AREA 1D | Lead | MG/KG | 155
T RANGE AREA 1D | Lead | MG/KG | 357
T RANGE AREA 1E | Lead | MG/KG | 172
T RANGE AREA 1E | Lead | MG/KG | 209
T RANGE AREA 1E | Lead | MG/KG | 135
T RANGE AREA 2A | Lead | MG/KG | 10
T RANGE LYS 11, 12, and 13 | Lead filtered | ug/L | All ND
T RANGE LYS 11, 12, and 13 | Lead total | ug/L | All ND
T RANGE AREA 1A | Nitroglycerin | UG/KG | 16800
T RANGE AREA 1A | Nitroglycerin | UG/KG | 12000
T RANGE AREA 1A | Nitroglycerin | UG/KG | 17500
T RANGE AREA 1B | Nitroglycerin | UG/KG | 3960
T RANGE AREA 1B | Nitroglycerin | UG/KG | 2170
T RANGE AREA 1B | Nitroglycerin | UG/KG | 3560
T RANGE AREA 1C | Nitroglycerin | UG/KG | 7400
T RANGE AREA 1C | Nitroglycerin | UG/KG | 3640
T RANGE AREA 1C | Nitroglycerin | UG/KG | 6210
T RANGE AREA 1D | Nitroglycerin | UG/KG | 8600
T RANGE AREA 1D | Nitroglycerin | UG/KG | 8940
T RANGE AREA 1D | Nitroglycerin | UG/KG | 15000
T RANGE AREA 1E | Nitroglycerin | UG/KG | 18700
T RANGE AREA 1E | Nitroglycerin | UG/KG | 13300
T RANGE AREA 1E | Nitroglycerin | UG/KG | 16900
TR-T-RANGE-AREA-1A
TR-T-RANGE-AREA-1B
TR-T-RANGE-AREA-1C
TR-T-RANGE-AREA-1D
TR-T-RANGE-AREA-1E
LYTRFL10
LYTRFL07
LYTRFL04
LY-TR-11
LY-TR-12
LY-TR-13
LYTR07C
LYTR07B
LYTR04

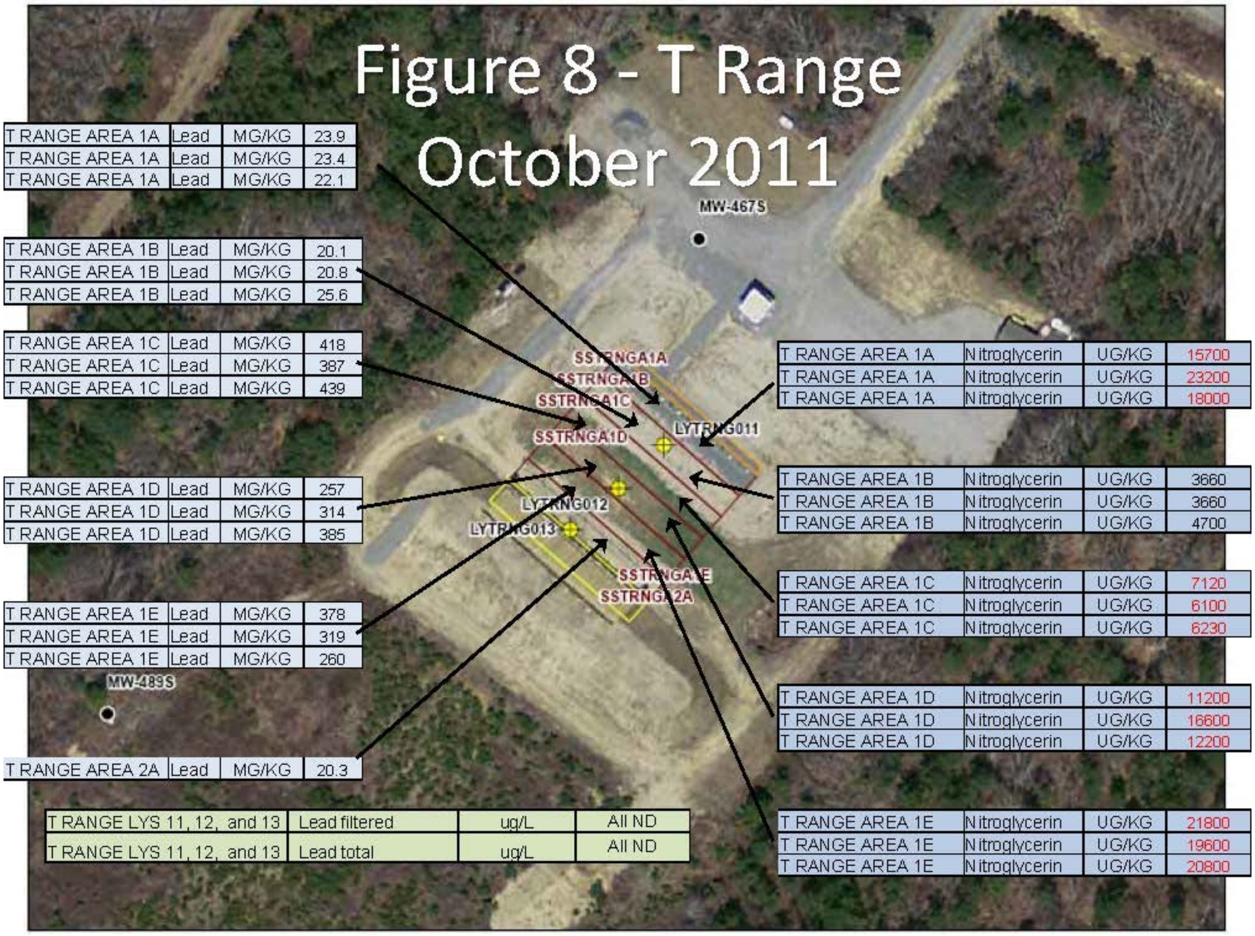
Figure 8 - T Range
October 2011
T RANGE AREA 1A Lead MG/KG 23.9
T RANGE AREA 1A Lead MG/KG 23.4
T RANGE AREA 1A Lead MG/KG 22.1
T RANGE AREA 1B Lead MG/KG 20.1
T RANGE AREA 1B Lead MG/KG 20.8
T RANGE AREA 1B Lead MG/KG 25.6
T RANGE AREA 1C Lead MG/KG 418
T RANGE AREA 1C Lead MG/KG 387
T RANGE AREA 1C Lead MG/KG 439
T RANGE AREA 1D Lead MG/KG 257
T RANGE AREA 1D Lead MG/KG 314
T RANGE AREA 1D Lead MG/KG 385
T RANGE AREA 1E Lead MG/KG 378
T RANGE AREA 1E Lead MG/KG 319
T RANGE AREA 1E Lead MG/KG 260
T RANGE AREA 2A Lead MG/KG 20.3
T RANGE LYS 11, 12, and 13 Lead filtered ug/L All ND
T RANGE LYS 11, 12, and 13 Lead total ug/L All ND
MW-467S
MW-489S
SSTRNGA1A
SSTRNGA1B
SSTRNGA1C
SSTRNGA1D
SSTRNGA1E
SSTRNGA2A
LYTRNG011
LYTRNG012
LYTRNG013
T RANGE AREA 1A Nitroglycerin UG/KG 15700
T RANGE AREA 1A Nitroglycerin UG/KG 23200
T RANGE AREA 1A Nitroglycerin UG/KG 18000
T RANGE AREA 1B Nitroglycerin UG/KG 3660
T RANGE AREA 1B Nitroglycerin UG/KG 3660
T RANGE AREA 1B Nitroglycerin UG/KG 4700
T RANGE AREA 1C Nitroglycerin UG/KG 7120
T RANGE AREA 1C Nitroglycerin UG/KG 6100
T RANGE AREA 1C Nitroglycerin UG/KG 6230
T RANGE AREA 1D Nitroglycerin UG/KG 11200
T RANGE AREA 1D Nitroglycerin UG/KG 16600
T RANGE AREA 1D Nitroglycerin UG/KG 12200
T RANGE AREA 1E Nitroglycerin UG/KG 21800
T RANGE AREA 1E Nitroglycerin UG/KG 19600
T RANGE AREA 1E Nitroglycerin UG/KG 20800

Attachment 1

J, K, and T Ranges Sampling and Analysis Data Report

By TetraTech

July 2011

Draft
J, K and T Ranges Sampling and Analysis Data Report

Massachusetts Military Reservation
Cape Cod, Massachusetts

July 2011

Prepared for:

U.S. Army Corps of Engineers
New England District
Concord, Massachusetts
for
Massachusetts Army National Guard
Camp Edwards, Massachusetts

Prepared by:

Tetra Tech EC, Inc.
160 Federal St., Boston, MA 02110
Contract No. DACW33-03-D-0006

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APPENDIX

1.0 FIELD ACTIVITIES SUMMARY

Field activities were initiated on May 23, 2011 in accordance with the *Scope of Work: J, K, and T Ranges Environmental Sampling, Spring 2011* Project Note (dated April 14, 2011). The project note summarizes the approved modifications to the Operations Maintenance and Monitoring/Best Management Practices Plans for the Juliet Range, Kilo Range and Tango Ranges. All samples were submitted to Test America Laboratory, Inc. in Burlington, Vermont for analysis. Results from the May 2011 sampling events are presented in data tables organized by Range and matrix in Appendix A.

1.1 Juliet Range

Multi-increment soil (MIS) samples were collected from six equal-sized grids (Areas 1 through 6) 5-meters wide and the full length of the firing line extending along the range floor from the firing line to the berm as shown in Figure 1.

One hundred point multi increment samples were collected from depth of 0 to 3 inches below ground surface (bgs) on May 26, 2011. Two replicate 100-point samples were also collected from Areas 1, 3 and 5. All samples were ground and processed in accordance with CRREL procedures. Samples collected from Areas 1 through 5 were submitted for lead, copper, zinc, and antimony analyses via Method 3050B/6010B, tungsten analysis via Method 6020 and nitroglycerin analysis via Method 8330B. The sample collected from Area 6 was submitted for lead, copper, zinc, and antimony analyses via Method 3050B/6010B and tungsten analysis via Method 6020.

Purge water samples were collected from three pan lysimeters (LYJRNG01, LYJRNG02 and LYJRNG03) on May 25 and 26, 2011. There was not sufficient rainfall during the following week to allow the collection of "fresh" water so the purge water samples were submitted for analysis. One half of the sample volume was field filtered and both unfiltered and filtered samples were submitted for analysis. Unfiltered (TOTAL) samples were submitted for lead, copper, antimony, zinc and tungsten analysis via Method 3050B/6020 and nitroglycerin via Method 8330B. Filtered (FLDFLT) samples were submitted for lead, copper, antimony and zinc analysis via Method 3050B/6020. Figure 1 shows locations of the pan lysimeters.

Groundwater samples were collected from two monitoring wells MW-471S and MW-472S on May 24 and 25, 2011. One half of the sample volume was field filtered and both unfiltered and filtered samples were submitted for analysis. Unfiltered (TOTAL) samples were submitted for lead, copper, antimony, zinc and tungsten analysis via Method 3050B/6020 and nitroglycerin via Method 8330B. Filtered (FLDFLT) samples were submitted for lead, copper, antimony and zinc analysis via Method 3050B/6020. Field duplicate samples were collected and submitted from MW-471S. Groundwater sample locations are shown on Figure 1.

A sample was collected from the STAPP system run off by the MAARNG on April 15, 2011 and submitted for TAL metals analysis by Method 3050B/6010B and tungsten analysis by Method 6020.

1.2 Kilo Range

Multi-increment soil (MIS) samples were collected from six equal-sized grids (Areas 1 through 6) 5-meters wide and the full length of the firing line extending along the range floor from the firing line to the berm as shown in Figure 2.

One hundred point multi increment samples were collected from depth of 0 to 3 inches below ground surface (bgs) on May 27 and 31, 2011. Two replicate 100-point samples were also collected from Areas 1, 3 and 5. All samples were ground and processed in accordance with CRREL procedures. Samples collected from Areas 1 through 5 were submitted for lead, copper, zinc, and antimony analyses via Method 3050B/6010B, tungsten analysis via Method 6020 and nitroglycerin analysis via Method 8330B. The sample collected from Area 6 was submitted for lead, copper, zinc, and antimony analyses via Method 3050B/6010B and tungsten analysis via Method 6020.

Purge water samples were collected from four pan lysimeters (LYKRNG01, LYKRNG02, LYKRNG03 and LYKRNG004) on May 26, 2011. There was not sufficient rainfall during the following week to allow the collection of "fresh" water so the purge water samples were submitted for analysis. One half of the sample volume was field filtered and both unfiltered and filtered samples were submitted for analysis. Unfiltered (TOTAL) samples were submitted for lead, copper, antimony, zinc and tungsten analysis via Method 3050B/6020 and nitroglycerin via Method 8330B. Filtered (FLDFLT) samples were submitted for lead, copper, antimony and zinc analysis via Method 3050B/6020. Field duplicate samples were collected and submitted from LYKRNG001. Figure 2 shows locations of the pan lysimeters.

Groundwater samples were collected from two monitoring wells MW-473S and MW-474S on May 24 and 25, 2011. One half of the sample volume was field filtered and both unfiltered and filtered samples were submitted for analysis. Unfiltered (TOTAL) samples were submitted for lead, copper, antimony, zinc and tungsten analysis via Method 3050B/6020 and nitroglycerin via Method 8330B. Filtered (FLDFLT) samples were submitted for lead, copper, antimony and zinc analysis via Method 3050B/6020. Groundwater sample locations are shown on Figure 2.

A sample was collected from the STAPP system run off by the MAARNG on April 15, 2011 and submitted for TAL metals analysis by Method 3050B/6010B and tungsten analysis by Method 6020.

1.3 Tango Range

Multi-increment soil (MIS) samples were collected from six equal-sized grids (Areas 1A through 1E and Area 2A) 5-meters wide and the full length of the firing line extending along the range floor from the firing line to the berm as shown in Figure 3.

One hundred point multi increment samples were collected from depth of 0 to 3 inches below ground surface (bgs) on May 23, 2011. Two replicate 100-point samples were also collected from each of the range floor areas (Areas 1A through 1E). All samples were ground and processed in accordance with CRREL procedures. Samples collected from Areas 1A through 1E were submitted for lead, copper, zinc, and antimony analyses via Method 3050B/6010B, tungsten analysis via Method 6020 and nitroglycerin analysis via Method 8330B. The sample collected from Area 2A was submitted for lead, copper, zinc, and antimony analyses via Method 3050B/6010B and tungsten analysis via Method 6020.

Purge water samples were collected from three pan lysimeters (LYTRNG011, LYTRNG012, and LYTRNG013) on May 24, 2011. There was not sufficient rainfall during the following week to allow the collection of "fresh" water so the purge water samples were submitted for analysis. One half of the sample volume was field filtered and both unfiltered and filtered samples were submitted for analysis. Unfiltered (TOTAL) samples were submitted for lead, copper, antimony, zinc and tungsten analysis via Method 3050B/6020 and nitroglycerin via Method 8330B. Filtered (FLDFLT) samples were submitted for lead, copper, antimony and zinc analysis via Method 3050B/6020. Figure 3 shows locations of the pan lysimeters.

Groundwater samples were collected from two monitoring wells MW-467S and MW-489S on May 24, 2011. One half of the sample volume was field filtered and both unfiltered and filtered samples were submitted for analysis. Unfiltered (TOTAL) samples were submitted for lead, copper, antimony, zinc and tungsten analysis via Method 3050B/6020 and nitroglycerin via Method 8330B. Filtered (FLDFLT) samples were submitted for lead, copper, antimony and zinc analysis via Method 3050B/6020. Groundwater sample locations are shown on Figure 3.

2.0 SUMMARY

All samples have been collected as planned and the data has been reviewed and validated in accordance with standard procedures. Sample results have been compared to Level 1 Interim Action Levels for antimony, lead, copper and nitroglycerin in soil, pore water and groundwater samples. Analytical data tables are presented by Range and matrix in Appendix A.

The lead and antimony results from the multi incremental soil samples collected from all ranges were less than the action levels of 4,545 mg/kg and 1,750 mg/kg, respectively. The results for nitroglycerin in the MIS samples collected from the Area 1 at the J and K Ranges, Area 5 at the K Range and Areas 1A, 1C, 1D and 1E at the T Range exceeded the action level of 5,000 µg/kg. The soil sample results for each range are presented in Tables 1, 4 and 7.

The lead, antimony and copper results from the lysimeter samples collected from all ranges were less than the action levels of 10 µg/L, 4.0 µg/L and 867 µg/L, respectively. The action level for nitroglycerin in pore water was 3.2 µg/L; the results for nitroglycerin in the lysimeter samples from all ranges were non-detect at 2 µg/L. The lysimeter sample results are presented in Tables 2, 5 and 8.

The lead, antimony and copper results from the groundwater samples collected from all ranges were less than the action levels of 5.0 µg/L, 2.0 µg/L and 434 µg/L, respectively. The action level for nitroglycerin in groundwater was 1.6 µg/L; the results for nitroglycerin in the groundwater samples from all ranges were non-detect at 2 µg/L with a method detection limit of 0.6 µg/L. The groundwater sample results are presented in Tables 3, 6 and 9.

There are no action levels for the STAPP sample results; results are presented in Table 10.

The data are usable for project related decisions.

FIGURES


MW-473S
LYJRNG003
SSJRNG006
MW-471S
SSJRNG005
SSJRNG004
LYJRNG002
SSJRNG003
SSJRNG002
LYJRNG001
SSJRNG001
MW-472S
MW-474S
LEGEND
Lysimeter
Monitoring Well
Sampling Grid
STAPP System
Firing Line
LOCATION MAP
NOTES AND SOURCES
TITLE
J Range
MIS Sampling Grids
0
50
Feet
N
FIGURE
1


MW-473S
MW-471S
MW-472S
MW-474S
LYKRNG004
LYKRNG003
LYKRNG002
LYKRNG001
SSKRNG006
SSKRNG005
SSKRNG004
SSKRNG003
SSKRNG002
SSKRNG001
LEGEND
Lysimeter
Monitoring Well
Sampling Grid
STAPP System
Firing Line
LOCATION MAP
NOTES AND SOURCES
TITLE
K Range
MIS Sampling Grids
0
50
Feet
N
FIGURE
2


MW-467S
SSTRNGA1A
SSTRNGA1B
SSTRNGA1C
SSTRNGA1D
LYTRNG011
LYTRNG012
LYTRNG013
SSTRNGA1E
SSTRNGA2A
MW-469S
LEGEND
Monitoring Well
Lysimeter
Sampling Grid
STAPP System
Firing Line
LOCATION MAP
NOTES AND SOURCES
TITLE
T Range
MIS Sampling Grids
0
100
Feet
N
FIGURE
3

APPENDIX A
Data Tables

Table 1
J Range Validated Soil Data

Site ID	Location ID	Field Sample ID	Northing	Easting	Date Sampled	Test Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]	Sample Type
J RANGE	SSJRNG001	SSJRNG001_A	4616341.33	371958.87	05/26/2011	SW6010B	Copper	15.8		MG/KG	0.078	1.2	N1
J RANGE	SSJRNG001	SSJRNG001_A	4616341.33	371958.87	05/26/2011	SW6010B	Lead	22.6		MG/KG	0.11	0.49	N1
J RANGE	SSJRNG001	SSJRNG001_A	4616341.33	371958.87	05/26/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	2.9	N1
J RANGE	SSJRNG001	SSJRNG001_A	4616341.33	371958.87	05/26/2011	SW6010B	Zinc	31.9		MG/KG	0.029	0.98	N1
J RANGE	SSJRNG001	SSJRNG001_A	4616341.33	371958.87	05/26/2011	SW6020	Tungsten	ND	U	MG/KG	0.011	0.16	N1
J RANGE	SSJRNG001	SSJRNG001_A	4616341.33	371958.87	05/26/2011	SW8330	Nitroglycerin	6260		UG/KG	608	1990	N1
J RANGE	SSJRNG001	SSJRNG001_B	4616341.33	371958.87	05/26/2011	SW6010B	Copper	15.8		MG/KG	0.079	1.2	FR1
J RANGE	SSJRNG001	SSJRNG001_B	4616341.33	371958.87	05/26/2011	SW6010B	Lead	32.1		MG/KG	0.11	0.50	FR1
J RANGE	SSJRNG001	SSJRNG001_B	4616341.33	371958.87	05/26/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	3.0	FR1
J RANGE	SSJRNG001	SSJRNG001_B	4616341.33	371958.87	05/26/2011	SW6010B	Zinc	30.9		MG/KG	0.030	0.99	FR1
J RANGE	SSJRNG001	SSJRNG001_B	4616341.33	371958.87	05/26/2011	SW6020	Tungsten	ND	U	MG/KG	0.011	0.18	FR1
J RANGE	SSJRNG001	SSJRNG001_B	4616341.33	371958.87	05/26/2011	SW8330	Nitroglycerin	11100		UG/KG	608	1990	FR1
J RANGE	SSJRNG001	SSJRNG001_C	4616341.33	371958.87	05/26/2011	SW6010B	Copper	14.5		MG/KG	0.080	1.2	FR1
J RANGE	SSJRNG001	SSJRNG001_C	4616341.33	371958.87	05/26/2011	SW6010B	Lead	34.3		MG/KG	0.11	0.50	FR1
J RANGE	SSJRNG001	SSJRNG001_C	4616341.33	371958.87	05/26/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	3.0	FR1
J RANGE	SSJRNG001	SSJRNG001_C	4616341.33	371958.87	05/26/2011	SW6010B	Zinc	29.4		MG/KG	0.030	1.0	FR1
J RANGE	SSJRNG001	SSJRNG001_C	4616341.33	371958.87	05/26/2011	SW6020	Tungsten	ND	U	MG/KG	0.012	0.16	FR1
J RANGE	SSJRNG001	SSJRNG001_C	4616341.33	371958.87	05/26/2011	SW8330	Nitroglycerin	9060		UG/KG	601	1960	FR1
J RANGE	SSJRNG002	SSJRNG002_A	4616345.37	371959.24	05/26/2011	SW6010B	Lead	42.3		MG/KG	0.11	0.50	N1
J RANGE	SSJRNG002	SSJRNG002_A	4616345.37	371959.24	05/26/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	3.0	N1
J RANGE	SSJRNG002	SSJRNG002_A	4616345.37	371959.24	05/26/2011	SW6010B	Copper	ND	U	MG/KG	0.080	8.0	N1
J RANGE	SSJRNG002	SSJRNG002_A	4616345.37	371959.24	05/26/2011	SW6010B	Zinc	21.6		MG/KG	0.030	1.0	N1
J RANGE	SSJRNG002	SSJRNG002_A	4616345.37	371959.24	05/26/2011	SW6020	Tungsten	ND	U	MG/KG	0.011	0.14	N1
J RANGE	SSJRNG002	SSJRNG002_A	4616345.37	371959.24	05/26/2011	SW8330	Nitroglycerin	1900	J	UG/KG	603	1970	N1
J RANGE	SSJRNG003	SSJRNG003_A	4616350.92	371959.2	05/26/2011	SW6010B	Lead	56.0		MG/KG	0.11	0.51	N1
J RANGE	SSJRNG003	SSJRNG003_A	4616350.92	371959.2	05/26/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	3.0	N1
J RANGE	SSJRNG003	SSJRNG003_A	4616350.92	371959.2	05/26/2011	SW6010B	Copper	ND	U	MG/KG	0.081	9.2	N1
J RANGE	SSJRNG003	SSJRNG003_A	4616350.92	371959.2	05/26/2011	SW6010B	Zinc	23.0		MG/KG	0.030	1.0	N1
J RANGE	SSJRNG003	SSJRNG003_A	4616350.92	371959.2	05/26/2011	SW6020	Tungsten	ND	U	MG/KG	0.012	0.16	N1
J RANGE	SSJRNG003	SSJRNG003_A	4616350.92	371959.2	05/26/2011	SW8330	Nitroglycerin	1430	J	UG/KG	624	2040	N1
J RANGE	SSJRNG003	SSJRNG003_B	4616350.92	371959.2	05/26/2011	SW6010B	Copper	11.2		MG/KG	0.080	1.2	FR1
J RANGE	SSJRNG003	SSJRNG003_B	4616350.92	371959.2	05/26/2011	SW6010B	Lead	192		MG/KG	0.11	0.50	FR1
J RANGE	SSJRNG003	SSJRNG003_B	4616350.92	371959.2	05/26/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	3.0	FR1
J RANGE	SSJRNG003	SSJRNG003_B	4616350.92	371959.2	05/26/2011	SW6010B	Zinc	21.9		MG/KG	0.030	1.0	FR1
J RANGE	SSJRNG003	SSJRNG003_B	4616350.92	371959.2	05/26/2011	SW6020	Tungsten	ND	U	MG/KG	0.011	0.28	FR1
J RANGE	SSJRNG003	SSJRNG003_B	4616350.92	371959.2	05/26/2011	SW8330	Nitroglycerin	2770	J	UG/KG	616	2010	FR1
J RANGE	SSJRNG003	SSJRNG003_C	4616350.92	371959.2	05/26/2011	SW6010B	Lead	48.8		MG/KG	0.11	0.50	FR1
J RANGE	SSJRNG003	SSJRNG003_C	4616350.92	371959.2	05/26/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	3.0	FR1
J RANGE	SSJRNG003	SSJRNG003_C	4616350.92	371959.2	05/26/2011	SW6010B	Copper	ND	U	MG/KG	0.080	8.9	FR1
J RANGE	SSJRNG003	SSJRNG003_C	4616350.92	371959.2	05/26/2011	SW6010B	Zinc	21.7		MG/KG	0.030	1.0	FR1
J RANGE	SSJRNG003	SSJRNG003_C	4616350.92	371959.2	05/26/2011	SW6020	Tungsten	ND	U	MG/KG	0.012	0.16	FR1
J RANGE	SSJRNG003	SSJRNG003_C	4616350.92	371959.2	05/26/2011	SW8330	Nitroglycerin	2000	J	UG/KG	613	2000	FR1

Tables1,4,7_JKTRangeSoilDataTables.xlsx

Table 1
J Range Validated Soil Data

Site ID	Location ID	Field Sample ID	Northing	Easting	Date Sampled	Test Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]	Sample Type
J RANGE	SSJRNG004	SSJRNG004_A	4616356.64	371959.22	05/26/2011	SW6010B	Lead	51.8		MG/KG	0.11	0.51	N1
J RANGE	SSJRNG004	SSJRNG004_A	4616356.64	371959.22	05/26/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	3.0	N1
J RANGE	SSJRNG004	SSJRNG004_A	4616356.64	371959.22	05/26/2011	SW6010B	Copper	ND	U	MG/KG	0.081	7.1	N1
J RANGE	SSJRNG004	SSJRNG004_A	4616356.64	371959.22	05/26/2011	SW6010B	Zinc	22.2		MG/KG	0.030	1.0	N1
J RANGE	SSJRNG004	SSJRNG004_A	4616356.64	371959.22	05/26/2011	SW6020	Tungsten	ND	U	MG/KG	0.012	0.12	N1
J RANGE	SSJRNG004	SSJRNG004_A	4616356.64	371959.22	05/26/2011	SW8330	Nitroglycerin	1960	J	UG/KG	596	1950	N1
J RANGE	SSJRNG005	SSJRNG005_A	4616362.08	371959.17	05/26/2011	SW6010B	Lead	37.3		MG/KG	0.11	0.50	N1
J RANGE	SSJRNG005	SSJRNG005_A	4616362.08	371959.17	05/26/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	3.0	N1
J RANGE	SSJRNG005	SSJRNG005_A	4616362.08	371959.17	05/26/2011	SW6010B	Copper	ND	U	MG/KG	0.080	6.8	N1
J RANGE	SSJRNG005	SSJRNG005_A	4616362.08	371959.17	05/26/2011	SW6010B	Zinc	22.3		MG/KG	0.030	1.0	N1
J RANGE	SSJRNG005	SSJRNG005_A	4616362.08	371959.17	05/26/2011	SW6020	Tungsten	ND	U	MG/KG	0.012	0.23	N1
J RANGE	SSJRNG005	SSJRNG005_A	4616362.08	371959.17	05/26/2011	SW8330	Nitroglycerin	1220	J	UG/KG	592	1940	N1
J RANGE	SSJRNG005	SSJRNG005_B	4616362.08	371959.17	05/26/2011	SW6010B	Lead	37.1		MG/KG	0.11	0.50	FR1
J RANGE	SSJRNG005	SSJRNG005_B	4616362.08	371959.17	05/26/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	3.0	FR1
J RANGE	SSJRNG005	SSJRNG005_B	4616362.08	371959.17	05/26/2011	SW6010B	Copper	ND	U	MG/KG	0.080	7.1	FR1
J RANGE	SSJRNG005	SSJRNG005_B	4616362.08	371959.17	05/26/2011	SW6010B	Zinc	22.5		MG/KG	0.030	1.0	FR1
J RANGE	SSJRNG005	SSJRNG005_B	4616362.08	371959.17	05/26/2011	SW6020	Tungsten	ND	U	MG/KG	0.011	0.13	FR1
J RANGE	SSJRNG005	SSJRNG005_B	4616362.08	371959.17	05/26/2011	SW8330	Nitroglycerin	1220	J	UG/KG	594	1940	FR1
J RANGE	SSJRNG005	SSJRNG005_C	4616362.08	371959.17	05/26/2011	SW6010B	Lead	49.0		MG/KG	0.11	0.49	FR1
J RANGE	SSJRNG005	SSJRNG005_C	4616362.08	371959.17	05/26/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	2.9	FR1
J RANGE	SSJRNG005	SSJRNG005_C	4616362.08	371959.17	05/26/2011	SW6010B	Copper	ND	U	MG/KG	0.078	7.8	FR1
J RANGE	SSJRNG005	SSJRNG005_C	4616362.08	371959.17	05/26/2011	SW6010B	Zinc	22.6		MG/KG	0.029	0.98	FR1
J RANGE	SSJRNG005	SSJRNG005_C	4616362.08	371959.17	05/26/2011	SW6020	Tungsten	ND	U	MG/KG	0.011	0.15	FR1
J RANGE	SSJRNG005	SSJRNG005_C	4616362.08	371959.17	05/26/2011	SW8330	Nitroglycerin	1810	J	UG/KG	607	1980	FR1
J RANGE	SSJRNG006	SSJRNG006_A	4616366.26	371958.99	05/26/2011	SW6010B	Lead	28.6		MG/KG	0.11	0.50	N1
J RANGE	SSJRNG006	SSJRNG006_A	4616366.26	371958.99	05/26/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	3.0	N1
J RANGE	SSJRNG006	SSJRNG006_A	4616366.26	371958.99	05/26/2011	SW6010B	Copper	ND	U	MG/KG	0.080	6.8	N1
J RANGE	SSJRNG006	SSJRNG006_A	4616366.26	371958.99	05/26/2011	SW6010B	Zinc	44.1		MG/KG	0.030	1.0	N1
J RANGE	SSJRNG006	SSJRNG006_A	4616366.26	371958.99	05/26/2011	SW6020	Tungsten	ND	U	MG/KG	0.011	0.33	N1

Notes:

[1] Qualifiers: U = Non-detect. J = Value is estimated less than the reporting limit or due to limitation identified in the data validation. UJ = The analyte was not detected above this value and is estimated due to limitation in the data validation.

[2] MDL = Method Detection Limit

[3] RL = Reporting Limit

Tables1,4,7_JKTRangeSoilDataTables.xlsx

Table 2
J Range Validated Lysimeter Data

Site ID	Location ID	Field Sample ID	Northing	Easting	Date Sampled	Test Method	Extraction Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]
J RANGE	LYJRNG001	LYJRNG001FA	4616347.89	371959.96	05/25/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	1.6	20.0
J RANGE	LYJRNG001	LYJRNG001FA	4616347.89	371959.96	05/25/2011	SW6020	FLDFLT	Copper	1.2	J	UG/L	0.89	20.0
J RANGE	LYJRNG001	LYJRNG001FA	4616347.89	371959.96	05/25/2011	SW6020	FLDFLT	Lead	3.4		UG/L	0.035	2.0
J RANGE	LYJRNG001	LYJRNG001FA	4616347.89	371959.96	05/25/2011	SW6020	FLDFLT	Zinc	1.6	J	UG/L	0.86	20.0
J RANGE	LYJRNG001	LYJRNG001UA	4616347.89	371959.96	05/25/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	1.6	20.0
J RANGE	LYJRNG001	LYJRNG001UA	4616347.89	371959.96	05/25/2011	SW6020	TOTAL	Copper	1.6	J	UG/L	0.89	20.0
J RANGE	LYJRNG001	LYJRNG001UA	4616347.89	371959.96	05/25/2011	SW6020	TOTAL	Lead	5.0		UG/L	0.035	2.0
J RANGE	LYJRNG001	LYJRNG001UA	4616347.89	371959.96	05/25/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.30	2.0
J RANGE	LYJRNG001	LYJRNG001UA	4616347.89	371959.96	05/25/2011	SW6020	TOTAL	Zinc	5.9	J	UG/L	0.86	20.0
J RANGE	LYJRNG001	LYJRNG001UA	4616347.89	371959.96	05/25/2011	SW8330	METHOD	Nitroglycerin	ND	UJ	UG/L	0.60	2.0
J RANGE	LYJRNG002	LYJRNG002FA	4616355.88	371960.05	05/25/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	1.6	20.0
J RANGE	LYJRNG002	LYJRNG002FA	4616355.88	371960.05	05/25/2011	SW6020	FLDFLT	Copper	ND	U	UG/L	0.89	20.0
J RANGE	LYJRNG002	LYJRNG002FA	4616355.88	371960.05	05/25/2011	SW6020	FLDFLT	Lead	ND	U	UG/L	0.035	2.1
J RANGE	LYJRNG002	LYJRNG002FA	4616355.88	371960.05	05/25/2011	SW6020	FLDFLT	Zinc	4.2	J	UG/L	0.86	20.0
J RANGE	LYJRNG002	LYJRNG002UA	4616355.88	371960.05	05/25/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	1.6	20.0
J RANGE	LYJRNG002	LYJRNG002UA	4616355.88	371960.05	05/25/2011	SW6020	TOTAL	Copper	1.0	J	UG/L	0.89	20.0
J RANGE	LYJRNG002	LYJRNG002UA	4616355.88	371960.05	05/25/2011	SW6020	TOTAL	Lead	4.4		UG/L	0.035	2.0
J RANGE	LYJRNG002	LYJRNG002UA	4616355.88	371960.05	05/25/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.30	2.0
J RANGE	LYJRNG002	LYJRNG002UA	4616355.88	371960.05	05/25/2011	SW6020	TOTAL	Zinc	3.4	J	UG/L	0.86	20.0
J RANGE	LYJRNG002	LYJRNG002UA	4616355.88	371960.05	05/25/2011	SW8330	METHOD	Nitroglycerin	ND	U	UG/L	0.60	2.0
J RANGE	LYJRNG003	LYJRNG003FA	4616368	371939.92	05/26/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	1.6	20.0
J RANGE	LYJRNG003	LYJRNG003FA	4616368	371939.92	05/26/2011	SW6020	FLDFLT	Copper	3.0	J	UG/L	0.89	20.0
J RANGE	LYJRNG003	LYJRNG003FA	4616368	371939.92	05/26/2011	SW6020	FLDFLT	Lead	2.7		UG/L	0.035	2.0
J RANGE	LYJRNG003	LYJRNG003FA	4616368	371939.92	05/26/2011	SW6020	FLDFLT	Zinc	3.5	J	UG/L	0.86	20.0
J RANGE	LYJRNG003	LYJRNG003UA	4616368	371939.92	05/26/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	1.6	20.0
J RANGE	LYJRNG003	LYJRNG003UA	4616368	371939.92	05/26/2011	SW6020	TOTAL	Copper	3.8	J	UG/L	0.89	20.0
J RANGE	LYJRNG003	LYJRNG003UA	4616368	371939.92	05/26/2011	SW6020	TOTAL	Lead	9.0		UG/L	0.035	2.0
J RANGE	LYJRNG003	LYJRNG003UA	4616368	371939.92	05/26/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.30	2.0
J RANGE	LYJRNG003	LYJRNG003UA	4616368	371939.92	05/26/2011	SW6020	TOTAL	Zinc	8.3	J	UG/L	0.86	20.0
J RANGE	LYJRNG003	LYJRNG003UA	4616368	371939.92	05/26/2011	SW8330	METHOD	Nitroglycerin	ND	U	UG/L	0.60	2.0

Notes:

[1] Qualifiers: U = Non-detect. J = Value is estimated less than the reporting limit or due to limitation identified in the data validation. UJ = The analyte was not detected above this value and is estimated due to limitation in the data validation.

[2] MDL = Method Detection Limit

[3] RL = Reporting Limit

JRange

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Table 3
J Range Validated Groundwater Data

Site ID	Location ID	Field Sample ID	Top depth (ft bgs)	Bottom Depth (ft bgs)	Date Sampled	Test Method	Extraction Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]
J RANGE	MW-471S	MW-471S_MAY11FA	84.59	94.59	05/25/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	1.6	20.0
J RANGE	MW-471S	MW-471S_MAY11FA	84.59	94.59	05/25/2011	SW6020	FLDFLT	Copper	ND	U	UG/L	0.89	20.0
J RANGE	MW-471S	MW-471S_MAY11FA	84.59	94.59	05/25/2011	SW6020	FLDFLT	Lead	ND	U	UG/L	0.51	2.0
J RANGE	MW-471S	MW-471S_MAY11FA	84.59	94.59	05/25/2011	SW6020	FLDFLT	Zinc	3.0	J	UG/L	0.86	20.0
J RANGE	MW-471S	MW-471S_MAY11FD	84.59	94.59	05/25/2011	SW6020	FLDFLT	Copper	1.0	J	UG/L	0.89	20.0
J RANGE	MW-471S	MW-471S_MAY11FD	84.59	94.59	05/25/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	1.6	20.0
J RANGE	MW-471S	MW-471S_MAY11FD	84.59	94.59	05/25/2011	SW6020	FLDFLT	Lead	ND	U	UG/L	0.43	2.0
J RANGE	MW-471S	MW-471S_MAY11FD	84.59	94.59	05/25/2011	SW6020	FLDFLT	Zinc	2.7	J	UG/L	0.86	20.0
J RANGE	MW-471S	MW-471S_MAY11UA	84.59	94.59	05/25/2011	SW8330	METHOD	Nitroglycerin	ND	U	UG/L	0.60	2.0
J RANGE	MW-471S	MW-471S_MAY11UA	84.59	94.59	05/25/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	1.6	20.0
J RANGE	MW-471S	MW-471S_MAY11UA	84.59	94.59	05/25/2011	SW6020	TOTAL	Copper	ND	U	UG/L	0.89	20.0
J RANGE	MW-471S	MW-471S_MAY11UA	84.59	94.59	05/25/2011	SW6020	TOTAL	Lead	ND	U	UG/L	0.42	2.0
J RANGE	MW-471S	MW-471S_MAY11UA	84.59	94.59	05/25/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.30	2.0
J RANGE	MW-471S	MW-471S_MAY11UA	84.59	94.59	05/25/2011	SW6020	TOTAL	Zinc	2.8	J	UG/L	0.86	20.0
J RANGE	MW-471S	MW-471S_MAY11UD	84.59	94.59	05/25/2011	SW8330	METHOD	Nitroglycerin	ND	U	UG/L	0.60	2.0
J RANGE	MW-471S	MW-471S_MAY11UD	84.59	94.59	05/25/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	1.6	20.0
J RANGE	MW-471S	MW-471S_MAY11UD	84.59	94.59	05/25/2011	SW6020	TOTAL	Copper	ND	U	UG/L	0.89	20.0
J RANGE	MW-471S	MW-471S_MAY11UD	84.59	94.59	05/25/2011	SW6020	TOTAL	Lead	ND	U	UG/L	0.41	2.0
J RANGE	MW-471S	MW-471S_MAY11UD	84.59	94.59	05/25/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.30	2.0
J RANGE	MW-471S	MW-471S_MAY11UD	84.59	94.59	05/25/2011	SW6020	TOTAL	Zinc	2.1	J	UG/L	0.86	20.0
J RANGE	MW-472S	MW-472S_MAY11FA	85.31	95.31	05/24/2011	SW6020	FLDFLT	Copper	1.9	J	UG/L	0.89	20.0
J RANGE	MW-472S	MW-472S_MAY11FA	85.31	95.31	05/24/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	1.6	20.0
J RANGE	MW-472S	MW-472S_MAY11FA	85.31	95.31	05/24/2011	SW6020	FLDFLT	Lead	ND	U	UG/L	0.28	2.0
J RANGE	MW-472S	MW-472S_MAY11FA	85.31	95.31	05/24/2011	SW6020	FLDFLT	Zinc	5.0	J	UG/L	0.86	20.0
J RANGE	MW-472S	MW-472S_MAY11UA	85.31	95.31	05/24/2011	SW8330	METHOD	Nitroglycerin	ND	U	UG/L	0.60	2.0
J RANGE	MW-472S	MW-472S_MAY11UA	85.31	95.31	05/24/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	1.6	20.0
J RANGE	MW-472S	MW-472S_MAY11UA	85.31	95.31	05/24/2011	SW6020	TOTAL	Copper	ND	U	UG/L	0.89	20.0
J RANGE	MW-472S	MW-472S_MAY11UA	85.31	95.31	05/24/2011	SW6020	TOTAL	Lead	ND	U	UG/L	0.30	2.0
J RANGE	MW-472S	MW-472S_MAY11UA	85.31	95.31	05/24/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.30	2.0
J RANGE	MW-472S	MW-472S_MAY11UA	85.31	95.31	05/24/2011	SW6020	TOTAL	Zinc	4.1	J	UG/L	0.86	20.0

Notes:

[1] Qualifiers: U = Non-detect. J = Value is estimated less than the reporting limit or due to limitation identified in the data validation. UJ = The analyte was not detected above this value and is estimated due to limitation in the data validation.

[2] MDL = Method Detection Limit

[3] RL = Reporting Limit

Table 4
K Range Validated Soil Data

Site ID	Location ID	Field Sample ID	Northing	Easting	Date Sampled	Test Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]	Sample Type
K RANGE	SSKRNG001	SSKRNG001_A	4616341.71	372041.94	05/27/2011	SW6010B	Copper	19.5		MG/KG	0.080	1.2	N1
K RANGE	SSKRNG001	SSKRNG001_A	4616341.71	372041.94	05/27/2011	SW6010B	Lead	15.6		MG/KG	0.11	0.50	N1
K RANGE	SSKRNG001	SSKRNG001_A	4616341.71	372041.94	05/27/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	3.0	N1
K RANGE	SSKRNG001	SSKRNG001_A	4616341.71	372041.94	05/27/2011	SW6010B	Zinc	25.6		MG/KG	0.030	1.0	N1
K RANGE	SSKRNG001	SSKRNG001_A	4616341.71	372041.94	05/27/2011	SW6020	Tungsten	ND	U	MG/KG	0.012	0.14	N1
K RANGE	SSKRNG001	SSKRNG001_A	4616341.71	372041.94	05/27/2011	SW8330	Nitroglycerin	7110		UG/KG	608	1990	N1
K RANGE	SSKRNG001	SSKRNG001_B	4616341.71	372041.94	05/27/2011	SW6010B	Copper	19.5		MG/KG	0.078	1.2	FR1
K RANGE	SSKRNG001	SSKRNG001_B	4616341.71	372041.94	05/27/2011	SW6010B	Lead	16.8		MG/KG	0.11	0.49	FR1
K RANGE	SSKRNG001	SSKRNG001_B	4616341.71	372041.94	05/27/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	2.9	FR1
K RANGE	SSKRNG001	SSKRNG001_B	4616341.71	372041.94	05/27/2011	SW6010B	Zinc	26.4		MG/KG	0.029	0.98	FR1
K RANGE	SSKRNG001	SSKRNG001_B	4616341.71	372041.94	05/27/2011	SW6020	Tungsten	ND	U	MG/KG	0.011	0.12	FR1
K RANGE	SSKRNG001	SSKRNG001_B	4616341.71	372041.94	05/27/2011	SW8330	Nitroglycerin	5540	J	UG/KG	610	1990	FR1
K RANGE	SSKRNG001	SSKRNG001_C	4616341.71	372041.94	05/27/2011	SW6010B	Copper	20.2		MG/KG	0.079	1.2	FR1
K RANGE	SSKRNG001	SSKRNG001_C	4616341.71	372041.94	05/27/2011	SW6010B	Lead	17.5		MG/KG	0.11	0.50	FR1
K RANGE	SSKRNG001	SSKRNG001_C	4616341.71	372041.94	05/27/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	3.0	FR1
K RANGE	SSKRNG001	SSKRNG001_C	4616341.71	372041.94	05/27/2011	SW6010B	Zinc	26.2		MG/KG	0.030	0.99	FR1
K RANGE	SSKRNG001	SSKRNG001_C	4616341.71	372041.94	05/27/2011	SW6020	Tungsten	ND	U	MG/KG	0.011	0.15	FR1
K RANGE	SSKRNG001	SSKRNG001_C	4616341.71	372041.94	05/27/2011	SW8330	Nitroglycerin	5380	J	UG/KG	598	1960	FR1
K RANGE	SSKRNG002	SSKRNG002_A	4616346.08	372042.19	05/27/2011	SW6010B	Lead	25.7		MG/KG	0.11	0.50	N1
K RANGE	SSKRNG002	SSKRNG002_A	4616346.08	372042.19	05/27/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	3.0	N1
K RANGE	SSKRNG002	SSKRNG002_A	4616346.08	372042.19	05/27/2011	SW6010B	Copper	ND	U	MG/KG	0.079	8.7	N1
K RANGE	SSKRNG002	SSKRNG002_A	4616346.08	372042.19	05/27/2011	SW6010B	Zinc	18.1		MG/KG	0.030	0.99	N1
K RANGE	SSKRNG002	SSKRNG002_A	4616346.08	372042.19	05/27/2011	SW6020	Tungsten	ND	U	MG/KG	0.011	0.15	N1
K RANGE	SSKRNG002	SSKRNG002_A	4616346.08	372042.19	05/27/2011	SW8330	Nitroglycerin	4110	J	UG/KG	587	1920	N1
K RANGE	SSKRNG003	SSKRNG003_A	4616351.28	372042.4	05/27/2011	SW6010B	Lead	23.8		MG/KG	0.11	0.52	N1
K RANGE	SSKRNG003	SSKRNG003_A	4616351.28	372042.4	05/27/2011	SW6010B	Antimony	ND	U	MG/KG	0.20	3.1	N1
K RANGE	SSKRNG003	SSKRNG003_A	4616351.28	372042.4	05/27/2011	SW6010B	Copper	ND	U	MG/KG	0.082	8.5	N1
K RANGE	SSKRNG003	SSKRNG003_A	4616351.28	372042.4	05/27/2011	SW6010B	Zinc	16.4		MG/KG	0.031	1.0	N1
K RANGE	SSKRNG003	SSKRNG003_A	4616351.28	372042.4	05/27/2011	SW6020	Tungsten	ND	U	MG/KG	0.012	0.12	N1
K RANGE	SSKRNG003	SSKRNG003_A	4616351.28	372042.4	05/27/2011	SW8330	Nitroglycerin	1570	J	UG/KG	611	2000	N1
K RANGE	SSKRNG003	SSKRNG003_B	4616351.28	372042.4	05/27/2011	SW6010B	Lead	24.0		MG/KG	0.11	0.49	FR1
K RANGE	SSKRNG003	SSKRNG003_B	4616351.28	372042.4	05/27/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	2.9	FR1
K RANGE	SSKRNG003	SSKRNG003_B	4616351.28	372042.4	05/27/2011	SW6010B	Copper	ND	U	MG/KG	0.078	7.4	FR1
K RANGE	SSKRNG003	SSKRNG003_B	4616351.28	372042.4	05/27/2011	SW6010B	Zinc	16.2		MG/KG	0.029	0.98	FR1
K RANGE	SSKRNG003	SSKRNG003_B	4616351.28	372042.4	05/27/2011	SW6020	Tungsten	ND	U	MG/KG	0.011	0.24	FR1
K RANGE	SSKRNG003	SSKRNG003_B	4616351.28	372042.4	05/27/2011	SW8330	Nitroglycerin	1810	J	UG/KG	593	1940	FR1
K RANGE	SSKRNG003	SSKRNG003_C	4616351.28	372042.4	05/27/2011	SW6010B	Lead	22.9		MG/KG	0.11	0.49	FR1
K RANGE	SSKRNG003	SSKRNG003_C	4616351.28	372042.4	05/27/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	2.9	FR1
K RANGE	SSKRNG003	SSKRNG003_C	4616351.28	372042.4	05/27/2011	SW6010B	Copper	ND	U	MG/KG	0.078	7.2	FR1
K RANGE	SSKRNG003	SSKRNG003_C	4616351.28	372042.4	05/27/2011	SW6010B	Zinc	16.2		MG/KG	0.029	0.98	FR1
K RANGE	SSKRNG003	SSKRNG003_C	4616351.28	372042.4	05/27/2011	SW6020	Tungsten	ND	U	MG/KG	0.011	0.11	FR1
K RANGE	SSKRNG003	SSKRNG003_C	4616351.28	372042.4	05/27/2011	SW8330	Nitroglycerin	2180	J	UG/KG	605	1980	FR1

Table 4
K Range Validated Soil Data

Site ID	Location ID	Field Sample ID	Northing	Easting	Date Sampled	Test Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]	Sample Type
K RANGE	SSKRNG004	SSKRNG004_A	4616355.92	372042.55	05/27/2011	SW6010B	Lead	25.3		MG/KG	0.11	0.49	N1
K RANGE	SSKRNG004	SSKRNG004_A	4616355.92	372042.55	05/27/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	2.9	N1
K RANGE	SSKRNG004	SSKRNG004_A	4616355.92	372042.55	05/27/2011	SW6010B	Copper	ND	U	MG/KG	0.078	6.8	N1
K RANGE	SSKRNG004	SSKRNG004_A	4616355.92	372042.55	05/27/2011	SW6010B	Zinc	17.0		MG/KG	0.029	0.98	N1
K RANGE	SSKRNG004	SSKRNG004_A	4616355.92	372042.55	05/27/2011	SW6020	Tungsten	ND	U	MG/KG	0.011	0.11	N1
K RANGE	SSKRNG004	SSKRNG004_A	4616355.92	372042.55	05/27/2011	SW8330	Nitroglycerin	3260	J	UG/KG	601	1960	N1
K RANGE	SSKRNG005	SSKRNG005_A	4616362	372042.36	05/27/2011	SW6010B	Lead	27.6		MG/KG	0.11	0.50	N1
K RANGE	SSKRNG005	SSKRNG005_A	4616362	372042.36	05/27/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	3.0	N1
K RANGE	SSKRNG005	SSKRNG005_A	4616362	372042.36	05/27/2011	SW6010B	Copper	ND	U	MG/KG	0.079	8.0	N1
K RANGE	SSKRNG005	SSKRNG005_A	4616362	372042.36	05/27/2011	SW6010B	Zinc	17.9		MG/KG	0.030	0.99	N1
K RANGE	SSKRNG005	SSKRNG005_A	4616362	372042.36	05/27/2011	SW6020	Tungsten	ND	U	MG/KG	0.011	0.13	N1
K RANGE	SSKRNG005	SSKRNG005_A	4616362	372042.36	05/27/2011	SW8330	Nitroglycerin	5620		UG/KG	598	1960	N1
K RANGE	SSKRNG005	SSKRNG005_B	4616362	372042.36	05/27/2011	SW6010B	Lead	30.0		MG/KG	0.11	0.49	FR1
K RANGE	SSKRNG005	SSKRNG005_B	4616362	372042.36	05/27/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	2.9	FR1
K RANGE	SSKRNG005	SSKRNG005_B	4616362	372042.36	05/27/2011	SW6010B	Copper	ND	U	MG/KG	0.078	7.2	FR1
K RANGE	SSKRNG005	SSKRNG005_B	4616362	372042.36	05/27/2011	SW6010B	Zinc	17.7		MG/KG	0.029	0.98	FR1
K RANGE	SSKRNG005	SSKRNG005_B	4616362	372042.36	05/27/2011	SW6020	Tungsten	ND	U	MG/KG	0.011	0.11	FR1
K RANGE	SSKRNG005	SSKRNG005_B	4616362	372042.36	05/27/2011	SW8330	Nitroglycerin	3400	J	UG/KG	614	2010	FR1
K RANGE	SSKRNG005	SSKRNG005_C	4616362	372042.36	05/31/2011	SW6010B	Lead	27.8		MG/KG	0.11	0.49	FR1
K RANGE	SSKRNG005	SSKRNG005_C	4616362	372042.36	05/31/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	3.0	FR1
K RANGE	SSKRNG005	SSKRNG005_C	4616362	372042.36	05/31/2011	SW6010B	Copper	ND	U	MG/KG	0.079	8.5	FR1
K RANGE	SSKRNG005	SSKRNG005_C	4616362	372042.36	05/31/2011	SW6010B	Zinc	18.1		MG/KG	0.030	0.99	FR1
K RANGE	SSKRNG005	SSKRNG005_C	4616362	372042.36	05/31/2011	SW6020	Tungsten	ND	U	MG/KG	0.011	0.13	FR1
K RANGE	SSKRNG005	SSKRNG005_C	4616362	372042.36	05/31/2011	SW8330	Nitroglycerin	1520	J	UG/KG	588	1920	FR1
K RANGE	SSKRNG006	SSKRNG006_A	4616366.35	372042.95	05/31/2011	SW6010B	Lead	21.1		MG/KG	0.11	0.49	N1
K RANGE	SSKRNG006	SSKRNG006_A	4616366.35	372042.95	05/31/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	3.0	N1
K RANGE	SSKRNG006	SSKRNG006_A	4616366.35	372042.95	05/31/2011	SW6010B	Copper	ND	U	MG/KG	0.079	7.9	N1
K RANGE	SSKRNG006	SSKRNG006_A	4616366.35	372042.95	05/31/2011	SW6010B	Zinc	32.8		MG/KG	0.030	0.99	N1
K RANGE	SSKRNG006	SSKRNG006_A	4616366.35	372042.95	05/31/2011	SW6020	Tungsten	ND	U	MG/KG	0.011	0.21	N1

Notes:

[1] Qualifiers: U = Non-detect. J = Value is estimated less than the reporting limit or due to limitation identified in the data validation. UJ = The analyte was not detected above this value and is estimated due to limitation in the data validation.

[2] MDL = Method Detection Limit

[3] RL = Reporting Limit

Table 5
K Range Validated Lysimeter Data

Site ID	Location ID	Field Sample ID	Northing	Easting	Date Sampled	Test Method	Extraction Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]
K RANGE	LYKRNG001	LYKRNG001FA	4616348.28	372042.38	05/26/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	1.6	20.0
K RANGE	LYKRNG001	LYKRNG001FA	4616348.28	372042.38	05/26/2011	SW6020	FLDFLT	Copper	2.1	J	UG/L	0.89	20.0
K RANGE	LYKRNG001	LYKRNG001FA	4616348.28	372042.38	05/26/2011	SW6020	FLDFLT	Lead	ND	U	UG/L	0.38	2.0
K RANGE	LYKRNG001	LYKRNG001FA	4616348.28	372042.38	05/26/2011	SW6020	FLDFLT	Zinc	3.6	J	UG/L	0.86	20.0
K RANGE	LYKRNG001	LYKRNG001FD	4616348.28	372042.38	05/26/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	1.6	20.0
K RANGE	LYKRNG001	LYKRNG001FD	4616348.28	372042.38	05/26/2011	SW6020	FLDFLT	Copper	2.7	J	UG/L	0.89	20.0
K RANGE	LYKRNG001	LYKRNG001FD	4616348.28	372042.38	05/26/2011	SW6020	FLDFLT	Lead	ND	U	UG/L	0.36	2.0
K RANGE	LYKRNG001	LYKRNG001FD	4616348.28	372042.38	05/26/2011	SW6020	FLDFLT	Zinc	6.7	J	UG/L	0.86	20.0
K RANGE	LYKRNG001	LYKRNG001UA	4616348.28	372042.38	05/26/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	1.6	20.0
K RANGE	LYKRNG001	LYKRNG001UA	4616348.28	372042.38	05/26/2011	SW6020	TOTAL	Copper	1.8	J	UG/L	0.89	20.0
K RANGE	LYKRNG001	LYKRNG001UA	4616348.28	372042.38	05/26/2011	SW6020	TOTAL	Lead	ND	U	UG/L	0.36	2.0
K RANGE	LYKRNG001	LYKRNG001UA	4616348.28	372042.38	05/26/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.30	2.0
K RANGE	LYKRNG001	LYKRNG001UA	4616348.28	372042.38	05/26/2011	SW6020	TOTAL	Zinc	4.5	J	UG/L	0.86	20.0
K RANGE	LYKRNG001	LYKRNG001UA	4616348.28	372042.38	05/26/2011	SW8330	METHOD	Nitroglycerin	ND	U	UG/L	0.60	2.0
K RANGE	LYKRNG001	LYKRNG001UD	4616348.28	372042.38	05/26/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	1.6	20.0
K RANGE	LYKRNG001	LYKRNG001UD	4616348.28	372042.38	05/26/2011	SW6020	TOTAL	Copper	1.8	J	UG/L	0.89	20.0
K RANGE	LYKRNG001	LYKRNG001UD	4616348.28	372042.38	05/26/2011	SW6020	TOTAL	Lead	ND	U	UG/L	0.35	2.0
K RANGE	LYKRNG001	LYKRNG001UD	4616348.28	372042.38	05/26/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.30	2.0
K RANGE	LYKRNG001	LYKRNG001UD	4616348.28	372042.38	05/26/2011	SW6020	TOTAL	Zinc	3.7	J	UG/L	0.86	20.0
K RANGE	LYKRNG001	LYKRNG001UD	4616348.28	372042.38	05/26/2011	SW8330	METHOD	Nitroglycerin	ND	U	UG/L	0.60	2.0
K RANGE	LYKRNG002	LYKRNG002FA	4616355.95	372042.03	05/26/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	1.6	20.0
K RANGE	LYKRNG002	LYKRNG002FA	4616355.95	372042.03	05/26/2011	SW6020	FLDFLT	Copper	2.1	J	UG/L	0.89	20.0
K RANGE	LYKRNG002	LYKRNG002FA	4616355.95	372042.03	05/26/2011	SW6020	FLDFLT	Lead	ND	U	UG/L	0.37	2.0
K RANGE	LYKRNG002	LYKRNG002FA	4616355.95	372042.03	05/26/2011	SW6020	FLDFLT	Zinc	3.5	J	UG/L	0.86	20.0
K RANGE	LYKRNG002	LYKRNG002UA	4616355.95	372042.03	05/26/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	1.6	20.0
K RANGE	LYKRNG002	LYKRNG002UA	4616355.95	372042.03	05/26/2011	SW6020	TOTAL	Copper	ND	U	UG/L	0.89	20.0
K RANGE	LYKRNG002	LYKRNG002UA	4616355.95	372042.03	05/26/2011	SW6020	TOTAL	Lead	ND	U	UG/L	0.64	2.0
K RANGE	LYKRNG002	LYKRNG002UA	4616355.95	372042.03	05/26/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.30	2.0
K RANGE	LYKRNG002	LYKRNG002UA	4616355.95	372042.03	05/26/2011	SW6020	TOTAL	Zinc	1.6	J	UG/L	0.86	20.0
K RANGE	LYKRNG002	LYKRNG002UA	4616355.95	372042.03	05/26/2011	SW8330	METHOD	Nitroglycerin	ND	U	UG/L	0.60	2.0
K RANGE	LYKRNG003	LYKRNG003FA	4616367.5	372076.56	05/26/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	1.6	20.0
K RANGE	LYKRNG003	LYKRNG003FA	4616367.5	372076.56	05/26/2011	SW6020	FLDFLT	Copper	1.2	J	UG/L	0.89	20.0
K RANGE	LYKRNG003	LYKRNG003FA	4616367.5	372076.56	05/26/2011	SW6020	FLDFLT	Lead	ND	U	UG/L	1.6	2.0
K RANGE	LYKRNG003	LYKRNG003FA	4616367.5	372076.56	05/26/2011	SW6020	FLDFLT	Zinc	1.8	J	UG/L	0.86	20.0
K RANGE	LYKRNG003	LYKRNG003UA	4616367.5	372076.56	05/26/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	1.6	20.0
K RANGE	LYKRNG003	LYKRNG003UA	4616367.5	372076.56	05/26/2011	SW6020	TOTAL	Copper	0.89	J	UG/L	0.89	20.0
K RANGE	LYKRNG003	LYKRNG003UA	4616367.5	372076.56	05/26/2011	SW6020	TOTAL	Lead	ND	U	UG/L	1.9	2.0
K RANGE	LYKRNG003	LYKRNG003UA	4616367.5	372076.56	05/26/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.30	2.0
K RANGE	LYKRNG003	LYKRNG003UA	4616367.5	372076.56	05/26/2011	SW6020	TOTAL	Zinc	3.8	J	UG/L	0.86	20.0
K RANGE	LYKRNG003	LYKRNG003UA	4616367.5	372076.56	05/26/2011	SW8330	METHOD	Nitroglycerin	ND	U	UG/L	0.60	2.0

Table 5
K Range Validated Lysimeter Data

Site ID	Location ID	Field Sample ID	Northing	Easting	Date Sampled	Test Method	Extraction Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]
K RANGE	LYKRNG004	LYKRNG004FA	4616367.19	372011.16	05/26/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	1.6	20.0
K RANGE	LYKRNG004	LYKRNG004FA	4616367.19	372011.16	05/26/2011	SW6020	FLDFLT	Copper	5.6	J	UG/L	0.89	20.0
K RANGE	LYKRNG004	LYKRNG004FA	4616367.19	372011.16	05/26/2011	SW6020	FLDFLT	Lead	2.5		UG/L	0.035	2.0
K RANGE	LYKRNG004	LYKRNG004FA	4616367.19	372011.16	05/26/2011	SW6020	FLDFLT	Zinc	3.6	J	UG/L	0.86	20.0
K RANGE	LYKRNG004	LYKRNG004UA	4616367.19	372011.16	05/26/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	1.6	20.0
K RANGE	LYKRNG004	LYKRNG004UA	4616367.19	372011.16	05/26/2011	SW6020	TOTAL	Copper	6.0	J	UG/L	0.89	20.0
K RANGE	LYKRNG004	LYKRNG004UA	4616367.19	372011.16	05/26/2011	SW6020	TOTAL	Lead	5.6		UG/L	0.035	2.0
K RANGE	LYKRNG004	LYKRNG004UA	4616367.19	372011.16	05/26/2011	SW6020	TOTAL	Tungsten	0.38	J	UG/L	0.30	2.0
K RANGE	LYKRNG004	LYKRNG004UA	4616367.19	372011.16	05/26/2011	SW6020	TOTAL	Zinc	4.5	J	UG/L	0.86	20.0
K RANGE	LYKRNG004	LYKRNG004UA	4616367.19	372011.16	05/26/2011	SW8330	METHOD	Nitroglycerin	ND	U	UG/L	0.60	2.0

Notes:

[1] Qualifiers: U = Non-detect. J = Value is estimated less than the reporting limit or due to limitation identified in the data validation. UJ = The analyte was not detected above this value and is estimated due to limitation in the data validation.

[2] MDL = Method Detection Limit

[3] RL = Reporting Limit

Table 6
K Range Validated Groundwater Data

Site ID	Location ID	Field Sample ID	Top depth (ft bgs)	Bottom Depth (ft bgs)	Date Sampled	Test Method	Extraction Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]
K RANGE	MW-473S	MW-473S_MAY11FA	83.38	93.38	05/25/2011	SW6020	FLDFLT	Copper	8.3	J	UG/L	0.89	20.0
K RANGE	MW-473S	MW-473S_MAY11FA	83.38	93.38	05/25/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	1.6	20.0
K RANGE	MW-473S	MW-473S_MAY11FA	83.38	93.38	05/25/2011	SW6020	FLDFLT	Lead	ND	U	UG/L	0.71	2.0
K RANGE	MW-473S	MW-473S_MAY11FA	83.38	93.38	05/25/2011	SW6020	FLDFLT	Zinc	7.0	J	UG/L	0.86	20.0
K RANGE	MW-473S	MW-473S_MAY11UA	83.38	93.38	05/25/2011	SW8330	METHOD	Nitroglycerin	ND	U	UG/L	0.60	2.0
K RANGE	MW-473S	MW-473S_MAY11UA	83.38	93.38	05/25/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	1.6	20.0
K RANGE	MW-473S	MW-473S_MAY11UA	83.38	93.38	05/25/2011	SW6020	TOTAL	Copper	ND	U	UG/L	0.89	20.0
K RANGE	MW-473S	MW-473S_MAY11UA	83.38	93.38	05/25/2011	SW6020	TOTAL	Lead	ND	U	UG/L	0.41	2.0
K RANGE	MW-473S	MW-473S_MAY11UA	83.38	93.38	05/25/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.30	2.0
K RANGE	MW-473S	MW-473S_MAY11UA	83.38	93.38	05/25/2011	SW6020	TOTAL	Zinc	2.8	J	UG/L	0.86	20.0
K RANGE	MW-474S	MW-474S_MAY11FA	86.44	96.44	05/25/2011	SW6020	FLDFLT	Copper	1.7	J	UG/L	0.89	20.0
K RANGE	MW-474S	MW-474S_MAY11FA	86.44	96.44	05/25/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	1.6	20.0
K RANGE	MW-474S	MW-474S_MAY11FA	86.44	96.44	05/25/2011	SW6020	FLDFLT	Lead	ND	U	UG/L	1.2	2.0
K RANGE	MW-474S	MW-474S_MAY11FA	86.44	96.44	05/25/2011	SW6020	FLDFLT	Zinc	13.0	J	UG/L	0.86	20.0
K RANGE	MW-474S	MW-474S_MAY11UA	86.44	96.44	05/25/2011	SW8330	METHOD	Nitroglycerin	ND	U	UG/L	0.60	2.0
K RANGE	MW-474S	MW-474S_MAY11UA	86.44	96.44	05/25/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	1.6	20.0
K RANGE	MW-474S	MW-474S_MAY11UA	86.44	96.44	05/25/2011	SW6020	TOTAL	Copper	ND	U	UG/L	0.89	20.0
K RANGE	MW-474S	MW-474S_MAY11UA	86.44	96.44	05/25/2011	SW6020	TOTAL	Lead	ND	U	UG/L	0.84	2.0
K RANGE	MW-474S	MW-474S_MAY11UA	86.44	96.44	05/25/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.30	2.0
K RANGE	MW-474S	MW-474S_MAY11UA	86.44	96.44	05/25/2011	SW6020	TOTAL	Zinc	3.6	J	UG/L	0.86	20.0

Notes:

[1] Qualifiers: U = Non-detect. J = Value is estimated less than the reporting limit or due to limitation identified in the data validation. UJ = The analyte was not detected above this value and is estimated due to limitation in the data validation.

[2] MDL = Method Detection Limit

[3] RL = Reporting Limit

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Table 7
T Range Validated Soil Data

Site ID	Location ID	Field Sample ID	Northing	Easting	Date Sampled	Test Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]	Sample Type
T RANGE	SSTRNGA1A	SSTRNG1A_A	4621047.58	373702.38	05/23/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	3.0	N1
T RANGE	SSTRNGA1A	SSTRNG1A_A	4621047.58	373702.38	05/23/2011	SW6010B	Copper	23.5		MG/KG	0.079	1.2	N1
T RANGE	SSTRNGA1A	SSTRNG1A_A	4621047.58	373702.38	05/23/2011	SW6010B	Lead	21.6		MG/KG	0.11	0.49	N1
T RANGE	SSTRNGA1A	SSTRNG1A_A	4621047.58	373702.38	05/23/2011	SW6010B	Zinc	30.7		MG/KG	0.030	0.99	N1
T RANGE	SSTRNGA1A	SSTRNG1A_A	4621047.58	373702.38	05/23/2011	SW6020	Tungsten	ND	U	MG/KG	0.011	0.15	N1
T RANGE	SSTRNGA1A	SSTRNG1A_A	4621047.58	373702.38	05/23/2011	SW8330	Nitroglycerin	16800		UG/KG	618	2020	N1
T RANGE	SSTRNGA1A	SSTRNG1A_B	4621047.58	373702.38	05/23/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	2.9	FR1
T RANGE	SSTRNGA1A	SSTRNG1A_B	4621047.58	373702.38	05/23/2011	SW6010B	Copper	56.7		MG/KG	0.078	1.2	FR1
T RANGE	SSTRNGA1A	SSTRNG1A_B	4621047.58	373702.38	05/23/2011	SW6010B	Lead	20.9		MG/KG	0.11	0.49	FR1
T RANGE	SSTRNGA1A	SSTRNG1A_B	4621047.58	373702.38	05/23/2011	SW6010B	Zinc	31.5		MG/KG	0.029	0.98	FR1
T RANGE	SSTRNGA1A	SSTRNG1A_B	4621047.58	373702.38	05/23/2011	SW6020	Tungsten	ND	U	MG/KG	0.011	0.11	FR1
T RANGE	SSTRNGA1A	SSTRNG1A_B	4621047.58	373702.38	05/23/2011	SW8330	Nitroglycerin	12000	J	UG/KG	596	1950	FR1
T RANGE	SSTRNGA1A	SSTRNG1A_C	4621047.58	373702.38	05/23/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	3.0	FR1
T RANGE	SSTRNGA1A	SSTRNG1A_C	4621047.58	373702.38	05/23/2011	SW6010B	Copper	22.9		MG/KG	0.079	1.2	FR1
T RANGE	SSTRNGA1A	SSTRNG1A_C	4621047.58	373702.38	05/23/2011	SW6010B	Lead	23.7		MG/KG	0.11	0.49	FR1
T RANGE	SSTRNGA1A	SSTRNG1A_C	4621047.58	373702.38	05/23/2011	SW6010B	Zinc	37.3		MG/KG	0.030	0.99	FR1
T RANGE	SSTRNGA1A	SSTRNG1A_C	4621047.58	373702.38	05/23/2011	SW6020	Tungsten	ND	U	MG/KG	0.011	0.13	FR1
T RANGE	SSTRNGA1A	SSTRNG1A_C	4621047.58	373702.38	05/23/2011	SW8330	Nitroglycerin	17500		UG/KG	614	2010	FR1
T RANGE	SSTRNGA1B	SSTRNG1B_A	4621044.14	373699.09	05/23/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	3.0	N1
T RANGE	SSTRNGA1B	SSTRNG1B_A	4621044.14	373699.09	05/23/2011	SW6010B	Copper	10.2		MG/KG	0.080	1.2	N1
T RANGE	SSTRNGA1B	SSTRNG1B_A	4621044.14	373699.09	05/23/2011	SW6010B	Lead	17.9		MG/KG	0.11	0.50	N1
T RANGE	SSTRNGA1B	SSTRNG1B_A	4621044.14	373699.09	05/23/2011	SW6010B	Zinc	23.5		MG/KG	0.030	1.0	N1
T RANGE	SSTRNGA1B	SSTRNG1B_A	4621044.14	373699.09	05/23/2011	SW6020	Tungsten	ND	U	MG/KG	0.012	0.12	N1
T RANGE	SSTRNGA1B	SSTRNG1B_A	4621044.14	373699.09	05/23/2011	SW8330	Nitroglycerin	3960	J	UG/KG	601	1960	N1
T RANGE	SSTRNGA1B	SSTRNG1B_B	4621044.14	373699.09	05/23/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	3.0	FR1
T RANGE	SSTRNGA1B	SSTRNG1B_B	4621044.14	373699.09	05/23/2011	SW6010B	Copper	16.4		MG/KG	0.079	1.2	FR1
T RANGE	SSTRNGA1B	SSTRNG1B_B	4621044.14	373699.09	05/23/2011	SW6010B	Lead	25.5		MG/KG	0.11	0.49	FR1
T RANGE	SSTRNGA1B	SSTRNG1B_B	4621044.14	373699.09	05/23/2011	SW6010B	Zinc	34.7		MG/KG	0.030	0.99	FR1
T RANGE	SSTRNGA1B	SSTRNG1B_B	4621044.14	373699.09	05/23/2011	SW6020	Tungsten	ND	U	MG/KG	0.011	0.19	FR1
T RANGE	SSTRNGA1B	SSTRNG1B_B	4621044.14	373699.09	05/23/2011	SW8330	Nitroglycerin	2170	J	UG/KG	599	1960	FR1
T RANGE	SSTRNGA1B	SSTRNG1B_C	4621044.14	373699.09	05/23/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	3.0	FR1
T RANGE	SSTRNGA1B	SSTRNG1B_C	4621044.14	373699.09	05/23/2011	SW6010B	Copper	14.2		MG/KG	0.079	1.2	FR1
T RANGE	SSTRNGA1B	SSTRNG1B_C	4621044.14	373699.09	05/23/2011	SW6010B	Lead	23.7		MG/KG	0.11	0.49	FR1
T RANGE	SSTRNGA1B	SSTRNG1B_C	4621044.14	373699.09	05/23/2011	SW6010B	Zinc	25.1		MG/KG	0.030	0.99	FR1
T RANGE	SSTRNGA1B	SSTRNG1B_C	4621044.14	373699.09	05/23/2011	SW6020	Tungsten	ND	U	MG/KG	0.011	0.17	FR1
T RANGE	SSTRNGA1B	SSTRNG1B_C	4621044.14	373699.09	05/23/2011	SW8330	Nitroglycerin	3560	J	UG/KG	614	2010	FR1
T RANGE	SSTRNGA1C	SSTRNG1C_A	4621040.45	373695.76	05/23/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	3.0	N1
T RANGE	SSTRNGA1C	SSTRNG1C_A	4621040.45	373695.76	05/23/2011	SW6010B	Copper	136		MG/KG	0.080	1.2	N1
T RANGE	SSTRNGA1C	SSTRNG1C_A	4621040.45	373695.76	05/23/2011	SW6010B	Lead	357		MG/KG	0.11	0.50	N1
T RANGE	SSTRNGA1C	SSTRNG1C_A	4621040.45	373695.76	05/23/2011	SW6010B	Zinc	41.3		MG/KG	0.030	1.0	N1
T RANGE	SSTRNGA1C	SSTRNG1C_A	4621040.45	373695.76	05/23/2011	SW6020	Tungsten	2.0		MG/KG	0.011	0.10	N1
T RANGE	SSTRNGA1C	SSTRNG1C_A	4621040.45	373695.76	05/23/2011	SW8330	Nitroglycerin	7400	J	UG/KG	616	2010	N1

TRange

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Table 7
T Range Validated Soil Data

Site ID	Location ID	Field Sample ID	Northing	Easting	Date Sampled	Test Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]	Sample Type
T RANGE	SSTRNGA1C	SSTRNG1C_B	4621040.45	373695.76	05/23/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	2.9	FR1
T RANGE	SSTRNGA1C	SSTRNG1C_B	4621040.45	373695.76	05/23/2011	SW6010B	Copper	86.5		MG/KG	0.078	1.2	FR1
T RANGE	SSTRNGA1C	SSTRNG1C_B	4621040.45	373695.76	05/23/2011	SW6010B	Lead	293		MG/KG	0.11	0.49	FR1
T RANGE	SSTRNGA1C	SSTRNG1C_B	4621040.45	373695.76	05/23/2011	SW6010B	Zinc	35.8		MG/KG	0.029	0.98	FR1
T RANGE	SSTRNGA1C	SSTRNG1C_B	4621040.45	373695.76	05/23/2011	SW6020	Tungsten	1.2		MG/KG	0.011	0.098	FR1
T RANGE	SSTRNGA1C	SSTRNG1C_B	4621040.45	373695.76	05/23/2011	SW8330	Nitroglycerin	3640	J	UG/KG	608	1990	FR1
T RANGE	SSTRNGA1C	SSTRNG1C_C	4621040.45	373695.76	05/23/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	3.0	FR1
T RANGE	SSTRNGA1C	SSTRNG1C_C	4621040.45	373695.76	05/23/2011	SW6010B	Copper	124		MG/KG	0.079	1.2	FR1
T RANGE	SSTRNGA1C	SSTRNG1C_C	4621040.45	373695.76	05/23/2011	SW6010B	Lead	293		MG/KG	0.11	0.50	FR1
T RANGE	SSTRNGA1C	SSTRNG1C_C	4621040.45	373695.76	05/23/2011	SW6010B	Zinc	34.7		MG/KG	0.030	0.99	FR1
T RANGE	SSTRNGA1C	SSTRNG1C_C	4621040.45	373695.76	05/23/2011	SW6020	Tungsten	2.5		MG/KG	0.011	0.099	FR1
T RANGE	SSTRNGA1C	SSTRNG1C_C	4621040.45	373695.76	05/23/2011	SW8330	Nitroglycerin	6210	J	UG/KG	616	2010	FR1
T RANGE	SSTRNGA1D	SSTRNG1D_A	4621036.81	373692.3	05/23/2011	SW6010B	Antimony	17.9		MG/KG	0.19	3.0	N1
T RANGE	SSTRNGA1D	SSTRNG1D_A	4621036.81	373692.3	05/23/2011	SW6010B	Copper	276		MG/KG	0.080	1.2	N1
T RANGE	SSTRNGA1D	SSTRNG1D_A	4621036.81	373692.3	05/23/2011	SW6010B	Lead	522		MG/KG	0.11	0.50	N1
T RANGE	SSTRNGA1D	SSTRNG1D_A	4621036.81	373692.3	05/23/2011	SW6010B	Zinc	48.4		MG/KG	0.030	1.0	N1
T RANGE	SSTRNGA1D	SSTRNG1D_A	4621036.81	373692.3	05/23/2011	SW6020	Tungsten	10.6		MG/KG	0.012	0.10	N1
T RANGE	SSTRNGA1D	SSTRNG1D_A	4621036.81	373692.3	05/23/2011	SW8330	Nitroglycerin	8600		UG/KG	613	2000	N1
T RANGE	SSTRNGA1D	SSTRNG1D_B	4621036.81	373692.3	05/23/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	3.0	FR1
T RANGE	SSTRNGA1D	SSTRNG1D_B	4621036.81	373692.3	05/23/2011	SW6010B	Copper	197		MG/KG	0.080	1.2	FR1
T RANGE	SSTRNGA1D	SSTRNG1D_B	4621036.81	373692.3	05/23/2011	SW6010B	Lead	155		MG/KG	0.11	0.50	FR1
T RANGE	SSTRNGA1D	SSTRNG1D_B	4621036.81	373692.3	05/23/2011	SW6010B	Zinc	28.9		MG/KG	0.030	1.0	FR1
T RANGE	SSTRNGA1D	SSTRNG1D_B	4621036.81	373692.3	05/23/2011	SW6020	Tungsten	6.9		MG/KG	0.011	0.10	FR1
T RANGE	SSTRNGA1D	SSTRNG1D_B	4621036.81	373692.3	05/23/2011	SW8330	Nitroglycerin	8940		UG/KG	592	1930	FR1
T RANGE	SSTRNGA1D	SSTRNG1D_C	4621036.81	373692.3	05/23/2011	SW6010B	Antimony	1.8	J	MG/KG	0.19	3.0	FR1
T RANGE	SSTRNGA1D	SSTRNG1D_C	4621036.81	373692.3	05/23/2011	SW6010B	Copper	265		MG/KG	0.080	1.3	FR1
T RANGE	SSTRNGA1D	SSTRNG1D_C	4621036.81	373692.3	05/23/2011	SW6010B	Lead	357		MG/KG	0.11	0.50	FR1
T RANGE	SSTRNGA1D	SSTRNG1D_C	4621036.81	373692.3	05/23/2011	SW6010B	Zinc	34.6		MG/KG	0.030	1.0	FR1
T RANGE	SSTRNGA1D	SSTRNG1D_C	4621036.81	373692.3	05/23/2011	SW6020	Tungsten	13.7		MG/KG	0.012	0.10	FR1
T RANGE	SSTRNGA1D	SSTRNG1D_C	4621036.81	373692.3	05/23/2011	SW8330	Nitroglycerin	15000		UG/KG	616	2010	FR1
T RANGE	SSTRNGA1E	SSTRNG1E_A	4621032.9	373689.03	05/23/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	3.0	N1
T RANGE	SSTRNGA1E	SSTRNG1E_A	4621032.9	373689.03	05/23/2011	SW6010B	Copper	58.5		MG/KG	0.079	1.2	N1
T RANGE	SSTRNGA1E	SSTRNG1E_A	4621032.9	373689.03	05/23/2011	SW6010B	Lead	172		MG/KG	0.11	0.50	N1
T RANGE	SSTRNGA1E	SSTRNG1E_A	4621032.9	373689.03	05/23/2011	SW6010B	Zinc	21.4		MG/KG	0.030	0.99	N1
T RANGE	SSTRNGA1E	SSTRNG1E_A	4621032.9	373689.03	05/23/2011	SW6020	Tungsten	2.7		MG/KG	0.011	0.099	N1
T RANGE	SSTRNGA1E	SSTRNG1E_A	4621032.9	373689.03	05/23/2011	SW8330	Nitroglycerin	18700		UG/KG	602	1970	N1
T RANGE	SSTRNGA1E	SSTRNG1E_B	4621032.9	373689.03	05/23/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	2.9	FR1
T RANGE	SSTRNGA1E	SSTRNG1E_B	4621032.9	373689.03	05/23/2011	SW6010B	Copper	51.2		MG/KG	0.078	1.2	FR1
T RANGE	SSTRNGA1E	SSTRNG1E_B	4621032.9	373689.03	05/23/2011	SW6010B	Lead	209		MG/KG	0.11	0.49	FR1
T RANGE	SSTRNGA1E	SSTRNG1E_B	4621032.9	373689.03	05/23/2011	SW6010B	Zinc	29.5		MG/KG	0.029	0.98	FR1
T RANGE	SSTRNGA1E	SSTRNG1E_B	4621032.9	373689.03	05/23/2011	SW6020	Tungsten	2.0		MG/KG	0.011	0.098	FR1
T RANGE	SSTRNGA1E	SSTRNG1E_B	4621032.9	373689.03	05/23/2011	SW8330	Nitroglycerin	13300		UG/KG	616	2010	FR1

Table 7
T Range Validated Soil Data

Site ID	Location ID	Field Sample ID	Northing	Easting	Date Sampled	Test Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]	Sample Type
T RANGE	SSTRNGA1E	SSTRNG1E_C	4621032.9	373689.03	05/23/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	3.0	FR1
T RANGE	SSTRNGA1E	SSTRNG1E_C	4621032.9	373689.03	05/23/2011	SW6010B	Copper	131		MG/KG	0.079	1.2	FR1
T RANGE	SSTRNGA1E	SSTRNG1E_C	4621032.9	373689.03	05/23/2011	SW6010B	Lead	135		MG/KG	0.11	0.50	FR1
T RANGE	SSTRNGA1E	SSTRNG1E_C	4621032.9	373689.03	05/23/2011	SW6010B	Zinc	47.1		MG/KG	0.030	0.99	FR1
T RANGE	SSTRNGA1E	SSTRNG1E_C	4621032.9	373689.03	05/23/2011	SW6020	Tungsten	2.5		MG/KG	0.011	0.099	FR1
T RANGE	SSTRNGA1E	SSTRNG1E_C	4621032.9	373689.03	05/23/2011	SW8330	Nitroglycerin	16900		UG/KG	603	1970	FR1
T RANGE	SSTRNGA2A	SSTRNG2A_A	4621029.53	373685.65	05/23/2011	SW6010B	Antimony	ND	U	MG/KG	0.19	3.0	N1
T RANGE	SSTRNGA2A	SSTRNG2A_A	4621029.53	373685.65	05/23/2011	SW6010B	Copper	8.9		MG/KG	0.080	1.2	N1
T RANGE	SSTRNGA2A	SSTRNG2A_A	4621029.53	373685.65	05/23/2011	SW6010B	Lead	10.3		MG/KG	0.11	0.50	N1
T RANGE	SSTRNGA2A	SSTRNG2A_A	4621029.53	373685.65	05/23/2011	SW6010B	Zinc	23.9		MG/KG	0.030	1.0	N1
T RANGE	SSTRNGA2A	SSTRNG2A_A	4621029.53	373685.65	05/23/2011	SW6020	Tungsten	ND	U	MG/KG	0.012	0.19	N1

Notes:

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[2] MDL = Method Detection Limit

[3] RL = Reporting Limit

Table 8
T Range Validated Lysimeter Data

Site ID	Location ID	Field Sample ID	Northing	Easting	Date Sampled	Test Method	Extraction Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]
T RANGE	LYTRNG011	LYTR011FA	4621043.62	373700.93	05/24/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	1.6	20.0
T RANGE	LYTRNG011	LYTR011FA	4621043.62	373700.93	05/24/2011	SW6020	FLDFLT	Copper	2.2	J	UG/L	0.89	20.0
T RANGE	LYTRNG011	LYTR011FA	4621043.62	373700.93	05/24/2011	SW6020	FLDFLT	Lead	ND	U	UG/L	0.90	2.0
T RANGE	LYTRNG011	LYTR011FA	4621043.62	373700.93	05/24/2011	SW6020	FLDFLT	Zinc	2.9	J	UG/L	0.86	20.0
T RANGE	LYTRNG011	LYTR011UA	4621043.62	373700.93	05/24/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	1.6	20.0
T RANGE	LYTRNG011	LYTR011UA	4621043.62	373700.93	05/24/2011	SW6020	TOTAL	Copper	2.1	J	UG/L	0.89	20.0
T RANGE	LYTRNG011	LYTR011UA	4621043.62	373700.93	05/24/2011	SW6020	TOTAL	Lead	ND	U	UG/L	0.91	2.0
T RANGE	LYTRNG011	LYTR011UA	4621043.62	373700.93	05/24/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.30	2.0
T RANGE	LYTRNG011	LYTR011UA	4621043.62	373700.93	05/24/2011	SW6020	TOTAL	Zinc	5.8	J	UG/L	0.86	20.0
T RANGE	LYTRNG011	LYTR011UA	4621043.62	373700.93	05/24/2011	SW8330	METHOD	Nitroglycerin	ND	U	UG/L	0.60	2.0
T RANGE	LYTRNG012	LYTR012FA	4621035.71	373692.76	05/24/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	1.6	20.0
T RANGE	LYTRNG012	LYTR012FA	4621035.71	373692.76	05/24/2011	SW6020	FLDFLT	Copper	1.4	J	UG/L	0.89	20.0
T RANGE	LYTRNG012	LYTR012FA	4621035.71	373692.76	05/24/2011	SW6020	FLDFLT	Lead	ND	U	UG/L	0.35	2.0
T RANGE	LYTRNG012	LYTR012FA	4621035.71	373692.76	05/24/2011	SW6020	FLDFLT	Zinc	4.6	J	UG/L	0.86	20.0
T RANGE	LYTRNG012	LYTR012UA	4621035.71	373692.76	05/24/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	1.6	20.0
T RANGE	LYTRNG012	LYTR012UA	4621035.71	373692.76	05/24/2011	SW6020	TOTAL	Copper	1.3	J	UG/L	0.89	20.0
T RANGE	LYTRNG012	LYTR012UA	4621035.71	373692.76	05/24/2011	SW6020	TOTAL	Lead	ND	U	UG/L	0.36	2.0
T RANGE	LYTRNG012	LYTR012UA	4621035.71	373692.76	05/24/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.30	2.0
T RANGE	LYTRNG012	LYTR012UA	4621035.71	373692.76	05/24/2011	SW6020	TOTAL	Zinc	3.8	J	UG/L	0.86	20.0
T RANGE	LYTRNG012	LYTR012UA	4621035.71	373692.76	05/24/2011	SW8330	METHOD	Nitroglycerin	ND	U	UG/L	0.60	2.0
T RANGE	LYTRNG013	LYTR013FA	4621028.28	373684.12	05/24/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	1.6	20.0
T RANGE	LYTRNG013	LYTR013FA	4621028.28	373684.12	05/24/2011	SW6020	FLDFLT	Copper	8.5	J	UG/L	0.89	20.0
T RANGE	LYTRNG013	LYTR013FA	4621028.28	373684.12	05/24/2011	SW6020	FLDFLT	Lead	ND	U	UG/L	0.26	2.0
T RANGE	LYTRNG013	LYTR013FA	4621028.28	373684.12	05/24/2011	SW6020	FLDFLT	Zinc	14.9	J	UG/L	0.86	20.0
T RANGE	LYTRNG013	LYTR013UA	4621028.28	373684.12	05/24/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	1.6	20.0
T RANGE	LYTRNG013	LYTR013UA	4621028.28	373684.12	05/24/2011	SW6020	TOTAL	Copper	1.4	J	UG/L	0.89	20.0
T RANGE	LYTRNG013	LYTR013UA	4621028.28	373684.12	05/24/2011	SW6020	TOTAL	Lead	ND	U	UG/L	0.26	2.0
T RANGE	LYTRNG013	LYTR013UA	4621028.28	373684.12	05/24/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.30	2.0
T RANGE	LYTRNG013	LYTR013UA	4621028.28	373684.12	05/24/2011	SW6020	TOTAL	Zinc	14.1	J	UG/L	0.86	20.0
T RANGE	LYTRNG013	LYTR013UA	4621028.28	373684.12	05/24/2011	SW8330	METHOD	Nitroglycerin	ND	UJ	UG/L	0.60	2.0

Notes:

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Table 9
T Range Validated Groundwater Data

Site ID	Location ID	Field Sample ID	Top depth (ft bgs)	Bottom Depth (ft bgs)	Date Sampled	Test Method	Extraction Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]
T RANGE	MW-467S	MW-467S_MAY11FA	124.94	134.94	05/24/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	1.6	20.0
T RANGE	MW-467S	MW-467S_MAY11FA	124.94	134.94	05/24/2011	SW6020	FLDFLT	Copper	ND	U	UG/L	0.89	20.0
T RANGE	MW-467S	MW-467S_MAY11FA	124.94	134.94	05/24/2011	SW6020	FLDFLT	Lead	ND	U	UG/L	0.23	2.0
T RANGE	MW-467S	MW-467S_MAY11FA	124.94	134.94	05/24/2011	SW6020	FLDFLT	Zinc	ND	U	UG/L	0.86	20.0
T RANGE	MW-467S	MW-467S_MAY11UA	124.94	134.94	05/24/2011	SW8330	METHOD	Nitroglycerin	ND	U	UG/L	0.60	2.0
T RANGE	MW-467S	MW-467S_MAY11UA	124.94	134.94	05/24/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	1.6	20.0
T RANGE	MW-467S	MW-467S_MAY11UA	124.94	134.94	05/24/2011	SW6020	TOTAL	Copper	ND	U	UG/L	0.89	20.0
T RANGE	MW-467S	MW-467S_MAY11UA	124.94	134.94	05/24/2011	SW6020	TOTAL	Lead	ND	U	UG/L	0.41	2.0
T RANGE	MW-467S	MW-467S_MAY11UA	124.94	134.94	05/24/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.30	2.0
T RANGE	MW-467S	MW-467S_MAY11UA	124.94	134.94	05/24/2011	SW6020	TOTAL	Zinc	6.0	J	UG/L	0.86	20.0
T RANGE	MW-489S	MW-489S_MAY11FA	124.58	134.58	05/24/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	1.6	20.0
T RANGE	MW-489S	MW-489S_MAY11FA	124.58	134.58	05/24/2011	SW6020	FLDFLT	Copper	ND	U	UG/L	0.89	20.0
T RANGE	MW-489S	MW-489S_MAY11FA	124.58	134.58	05/24/2011	SW6020	FLDFLT	Lead	ND	U	UG/L	0.24	2.0
T RANGE	MW-489S	MW-489S_MAY11FA	124.58	134.58	05/24/2011	SW6020	FLDFLT	Zinc	ND	U	UG/L	0.86	20.0
T RANGE	MW-489S	MW-489S_MAY11UA	124.58	134.58	05/24/2011	SW6020	TOTAL	Copper	3.6	J	UG/L	0.89	20.0
T RANGE	MW-489S	MW-489S_MAY11UA	124.58	134.58	05/24/2011	SW8330	METHOD	Nitroglycerin	ND	U	UG/L	0.60	2.0
T RANGE	MW-489S	MW-489S_MAY11UA	124.58	134.58	05/24/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	1.6	20.0
T RANGE	MW-489S	MW-489S_MAY11UA	124.58	134.58	05/24/2011	SW6020	TOTAL	Lead	ND	U	UG/L	0.42	2.0
T RANGE	MW-489S	MW-489S_MAY11UA	124.58	134.58	05/24/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.30	2.0
T RANGE	MW-489S	MW-489S_MAY11UA	124.58	134.58	05/24/2011	SW6020	TOTAL	Zinc	3.0	J	UG/L	0.86	20.0

Notes:

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[2] MDL = Method Detection Limit

[3] RL = Reporting Limit

Table 10
J abd K Ranges Validated STAPP Data

Site ID	Location ID	Field Sample ID	Date Sampled	Test Method	Extraction Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]
J RANGE	WLJRNG	WSJRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Aluminum	132	J	UG/L	39.0	200
J RANGE	WLJRNG	WSJRSTAPP_0411	04/15/2011	SW6020	TOTAL	Antimony	61.5		UG/L	1.6	20.0
J RANGE	WLJRNG	WSJRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Barium	54.9	J	UG/L	5.2	200
J RANGE	WLJRNG	WSJRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Boron	42.7	J	UG/L	1.7	100
J RANGE	WLJRNG	WSJRSTAPP_0411	04/15/2011	SW6020	TOTAL	Cadmium	0.36	J	UG/L	0.070	2.0
J RANGE	WLJRNG	WSJRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Calcium	30300		UG/L	120	5000
J RANGE	WLJRNG	WSJRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Iron	1130		UG/L	39.0	200
J RANGE	WLJRNG	WSJRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Lead	12.3		UG/L	5.4	10.0
J RANGE	WLJRNG	WSJRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Magnesium	11800		UG/L	64.0	5000
J RANGE	WLJRNG	WSJRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Manganese	59.8		UG/L	1.9	15.0
J RANGE	WLJRNG	WSJRSTAPP_0411	04/15/2011	SW7470A	TOTAL	Mercury	ND	U	UG/L	0.066	0.20
J RANGE	WLJRNG	WSJRSTAPP_0411	04/15/2011	SW6020	TOTAL	Arsenic	ND	U	UG/L	0.037	2.0
J RANGE	WLJRNG	WSJRSTAPP_0411	04/15/2011	SW6020	TOTAL	Beryllium	ND	U	UG/L	0.053	2.0
J RANGE	WLJRNG	WSJRSTAPP_0411	04/15/2011	SW6020	TOTAL	Thallium	ND	U	UG/L	0.049	2.0
J RANGE	WLJRNG	WSJRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Chromium, Total	ND	U	UG/L	0.55	10.0
J RANGE	WLJRNG	WSJRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Cobalt	ND	U	UG/L	0.92	50.0
J RANGE	WLJRNG	WSJRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Copper	ND	U	UG/L	1.6	25.0
J RANGE	WLJRNG	WSJRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Molybdenum	ND	U	UG/L	1.5	10.0
J RANGE	WLJRNG	WSJRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Silver	ND	U	UG/L	2.1	10.0
J RANGE	WLJRNG	WSJRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Vanadium	ND	U	UG/L	1.6	50.0
J RANGE	WLJRNG	WSJRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Nickel	5.9	J	UG/L	1.8	40.0
J RANGE	WLJRNG	WSJRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Potassium	1600	J	UG/L	180	5000
J RANGE	WLJRNG	WSJRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Selenium	7.0	J	UG/L	6.1	35.0
J RANGE	WLJRNG	WSJRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Sodium	3390	J	UG/L	51.0	5000
J RANGE	WLJRNG	WSJRSTAPP_0411	04/15/2011	SW6020	TOTAL	Tungsten	0.50	J	UG/L	0.30	2.0
J RANGE	WLJRNG	WSJRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Zinc	11500		UG/L	0.75	20.0
K RANGE	WLKRNG	WSKRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Aluminum	41.0	J	UG/L	39.0	200
K RANGE	WLKRNG	WSKRSTAPP_0411	04/15/2011	SW6020	TOTAL	Antimony	173		UG/L	1.6	20.0
K RANGE	WLKRNG	WSKRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Barium	138	J	UG/L	5.2	200
K RANGE	WLKRNG	WSKRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Boron	125		UG/L	1.7	100
K RANGE	WLKRNG	WSKRSTAPP_0411	04/15/2011	SW6020	TOTAL	Cadmium	0.68	J	UG/L	0.070	2.0
K RANGE	WLKRNG	WSKRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Calcium	54300		UG/L	120	5000
K RANGE	WLKRNG	WSKRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Iron	2680		UG/L	39.0	200
K RANGE	WLKRNG	WSKRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Lead	14.2		UG/L	5.4	10.0
K RANGE	WLKRNG	WSKRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Magnesium	18400		UG/L	64.0	5000
K RANGE	WLKRNG	WSKRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Manganese	42.3		UG/L	1.9	15.0
K RANGE	WLKRNG	WSKRSTAPP_0411	04/15/2011	SW7470A	TOTAL	Mercury	ND	U	UG/L	0.066	0.20
K RANGE	WLKRNG	WSKRSTAPP_0411	04/15/2011	SW6020	TOTAL	Arsenic	ND	U	UG/L	0.037	2.0
K RANGE	WLKRNG	WSKRSTAPP_0411	04/15/2011	SW6020	TOTAL	Beryllium	ND	U	UG/L	0.053	2.0
K RANGE	WLKRNG	WSKRSTAPP_0411	04/15/2011	SW6020	TOTAL	Thallium	ND	U	UG/L	0.049	2.0

J and K Range

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Table 10
J abd K Ranges Validated STAPP Data

Site ID	Location ID	Field Sample ID	Date Sampled	Test Method	Extraction Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]
K RANGE	WLKRNG	WSKRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Chromium, Total	ND	U	UG/L	0.55	10.0
K RANGE	WLKRNG	WSKRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Cobalt	ND	U	UG/L	0.92	50.0
K RANGE	WLKRNG	WSKRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Copper	ND	U	UG/L	1.6	25.0
K RANGE	WLKRNG	WSKRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Molybdenum	ND	U	UG/L	1.5	10.0
K RANGE	WLKRNG	WSKRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Selenium	ND	U	UG/L	6.1	35.0
K RANGE	WLKRNG	WSKRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Silver	ND	U	UG/L	2.1	10.0
K RANGE	WLKRNG	WSKRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Vanadium	ND	U	UG/L	1.6	50.0
K RANGE	WLKRNG	WSKRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Nickel	12.6	J	UG/L	1.8	40.0
K RANGE	WLKRNG	WSKRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Potassium	1760	J	UG/L	180	5000
K RANGE	WLKRNG	WSKRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Sodium	4750	J	UG/L	51.0	5000
K RANGE	WLKRNG	WSKRSTAPP_0411	04/15/2011	SW6020	TOTAL	Tungsten	0.37	J	UG/L	0.30	2.0
K RANGE	WLKRNG	WSKRSTAPP_0411	04/15/2011	SW6010B	TOTAL	Zinc	10400		UG/L	0.75	20.0

Notes:
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[2] MDL = Method Detection Limit
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J and K Range

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Attachment 2

J, K, and T Ranges Sampling and Analysis Data Report

By TetraTech

December 2011

Draft
J, K and T Ranges Sampling and Analysis Data Report

Massachusetts Military Reservation
Cape Cod, Massachusetts

December 2011

Prepared for:

U.S. Army Corps of Engineers
New England District
Concord, Massachusetts
for
Massachusetts Army National Guard
Camp Edwards, Massachusetts

Prepared by:

Tetra Tech EC, Inc.
160 Federal St., Boston, MA 02110
Contract No. DACW33-03-D-0006

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FIGURES

APPENDIX

1.0 FIELD ACTIVITIES SUMMARY

Field activities for the Fall 2011 Sampling Event were initiated on October 5, 2011 in accordance with the *Statement of Work: Range Control Small Arms Ranges Sampling* (dated August 23, 2011). The statement of work summarizes the approved modifications to the Operations Maintenance and Monitoring/Best Management Practices Plans for the Juliet Range, Kilo Range and Tango Ranges. All samples were submitted to Test America Laboratory, Inc. in Burlington, Vermont for analysis. Results from the October 2011 sampling events are presented in data tables organized by Range and matrix in Appendix A.

1.1 Juliet Range

Soil samples were collected using the incremental sampling method from six equal-sized grids (Areas 1 through 6) 5-meters wide and the full length of the firing line extending along the range floor from the firing line to the berm as shown in Figure 1.

One hundred point composite samples were collected from depth of 0 to 3 inches below ground surface (bgs) on October 13, 2011. Two replicate 100-point samples were also collected from Areas 1, 3 and 5. All samples were ground and processed in accordance with Method 8330B. Samples collected from Areas 1 through 5 were submitted for lead, copper, antimony, zinc and tungsten analyses via Method 3050B/6020 and nitroglycerin analysis via Method 8330B. The sample collected from Area 6 was submitted for lead, copper, antimony, zinc and tungsten analyses via Method 3050B/6020.

Vadose zone water samples were collected from three pan lysimeters (LYJRNG01, LYJRNG02 and LYJRNG03) on October 11 and 12, 2011. One half of the sample volume was field filtered and both unfiltered and filtered samples were submitted for analysis. Unfiltered (TOTAL) samples were submitted for lead, copper, antimony, zinc and tungsten analysis via Method 3050B/6020 and nitroglycerin via Method 8330B. Filtered (FLDFLT) samples were submitted for lead, copper, antimony and zinc analysis via Method 3050B/6020. Figure 1 shows locations of the pan lysimeters.

Groundwater samples were collected from two monitoring wells MW-471S and MW-472S on October 5 and 6, 2011. One half of the sample volume was field filtered and both unfiltered and filtered samples were submitted for analysis. Unfiltered (TOTAL) samples were submitted for lead, copper, antimony, zinc and tungsten analysis via Method 3050B/6020 and nitroglycerin via Method 8330B. Filtered (FLDFLT) samples were submitted for lead, copper, antimony and zinc analysis via Method 3050B/6020. Groundwater sample locations are shown on Figure 1.

A sample was collected from the water accumulated in the STAPP system on October 13, 2011 and an unfiltered sample was submitted for TAL metals analysis by Method 3050B/6010B/6020 and tungsten analysis by Method 6020.

1.2 Kilo Range

Soil samples were collected using the incremental sampling method from six equal-sized grids (Areas 1 through 6) 5-meters wide and the full length of the firing line extending along the range floor from the firing line to the berm as shown in Figure 2.

One hundred point composite samples were collected from depth of 0 to 3 inches below ground surface (bgs) on October 14, 18 and 20, 2011. Two replicate 100-point samples were also collected from Areas 1, 3 and 5. All samples were ground and processed in accordance with Method 8330B. Samples collected from Areas 1 through 5 were submitted for lead, copper, antimony, zinc and tungsten analyses via Method 3050B/6020 and nitroglycerin analysis via Method 8330B. The sample collected from Area 6 was submitted for lead, copper, antimony, zinc and tungsten analyses via Method 3050B/6020.

Vadose zone water samples were collected from four pan lysimeters (LYKRNG001, LYKRNG002, LYKRNG003 and LYKRNG004) on October 12, 2011. One half of the sample volume was field filtered and both unfiltered and filtered samples were submitted for analysis. Unfiltered (TOTAL) samples were submitted for lead, copper, antimony, zinc and tungsten analysis via Method 3050B/6020 and nitroglycerin via Method 8330B. Filtered (FLDFLT) samples were submitted for lead, copper, antimony and zinc analysis via Method 3050B/6020. Field duplicate samples were collected and submitted from LYKRNG004. There was insufficient volume of water for all analyses in the lysimeter located at LYKRNG001 during sample collection on October 12, 2011. A sample was collected on October 21, 2011 and an unfiltered sample was submitted for nitroglycerin analysis. Metals were analyzed from the pore water samples collected October 12, 2011. Figure 2 shows locations of the pan lysimeters.

Groundwater samples were collected from two monitoring wells MW-473S and MW-474S on October 5, 2011. One half of the sample volume was field filtered and both unfiltered and filtered samples were submitted for analysis. Unfiltered (TOTAL) samples were submitted for lead, copper, antimony, zinc and tungsten analysis via Method 3050B/6020 and nitroglycerin via Method 8330B. Filtered (FLDFLT) samples were submitted for lead, copper, antimony and zinc analysis via Method 3050B/6020. Groundwater sample locations are shown on Figure 2.

A sample was collected from the water accumulated in the STAPP system on October 12, 2011 and an unfiltered sample was submitted for TAL metals analysis by Method 3050B/6010B/6020 and tungsten analysis by Method 6020.

1.3 Tango Range

Soil samples were collected using the incremental sampling method from six equal-sized grids (Areas 1A through 1E and Area 2A) 5-meters wide and the full length of the firing line extending along the range floor from the firing line to the berm as shown in Figure 3.

One hundred point composite samples were collected from depth of 0 to 3 inches below ground surface (bgs) on October 20 and 21, 2011. Two replicate 100-point samples were also collected from each of the range floor areas (Areas 1A through 1E). All samples were ground and processed in accordance with Method 8330B. Samples collected from Areas 1A through 1E were submitted for lead, copper, zinc, antimony and tungsten analyses via Method 3050B/6020 and nitroglycerin analysis via Method 8330B. The sample collected from Area 2A was submitted for lead, copper, zinc, antimony and tungsten analyses via Method 3050B/6020.

Vadose zone water samples were collected from three pan lysimeters (LYTRNG011, LYTRNG012, and LYTRNG013) on October 11, 2011. One half of the sample volume was field filtered and both unfiltered and filtered samples were submitted for analysis. Unfiltered (TOTAL) samples were submitted for lead, copper, antimony, zinc and tungsten analysis via Method 3050B/6020 and nitroglycerin via Method 8330B. Filtered (FLDFLT) samples were submitted for lead, copper, antimony and zinc analysis via Method 3050B/6020. Figure 3 shows locations of the pan lysimeters.

Groundwater samples were collected from two monitoring wells MW-467S and MW-489S on October 10 and 11, 2011. One half of the sample volume was field filtered and both unfiltered and filtered samples were submitted for analysis. Unfiltered (TOTAL) samples were submitted for lead, copper, antimony, zinc and tungsten analysis via Method 3050B/6020 and nitroglycerin via Method 8330B. Filtered (FLDFLT) samples were submitted for lead, copper, antimony and zinc analysis via Method 3050B/6020. Groundwater sample locations are shown on Figure 3.

A sample was collected from the water accumulated in the STAPP system on October 12, 2011 and an unfiltered sample was submitted for TAL metals analysis by Method 3050B/6010B/6020 and tungsten analysis by Method 6020.

2.0 SUMMARY

All samples have been collected in accordance with the August 2011 SOW and the data has been reviewed and validated in accordance with standard procedures. Sample results have been compared to Level 1 Interim Action Levels for antimony, lead, copper and nitroglycerin in soil, pore water and groundwater samples. Analytical data tables are presented by Range and matrix in Appendix A.

The lead and antimony results from the multi-point composite soil samples collected from all ranges were less than the action levels of 4,545 mg/kg and 1,750 mg/kg, respectively. The results for nitroglycerin in the MIS samples collected from the Area 1 at the J and K Ranges and Areas 1A, 1C, 1D and 1E at the T Range exceeded the action level of 5,000 µg/kg. The soil sample results for each range are presented in Tables 1, 4 and 7.

The lead, antimony and copper results from the lysimeter samples collected from all ranges were less than the action levels of 10 µg/L, 4.0 µg/L and 867 µg/L, respectively. The action level for nitroglycerin in pore water was 3.2 µg/L.

As noted above, the lysimeter samples that were submitted were pore water that had accumulated in the lysimeter since the last sampling event in May 2011. The matrix of these samples presented major interferences in the analysis for nitroglycerin. The analytical results were thoroughly reviewed and the majority of the samples were non-detect at levels below the action level of 3.2 ug/L. However, there were three samples where it was necessary to report nitroglycerin as non-detect with elevated reporting limits above the action level. The results for these samples [LYKRNG004 (samples and FD) and LYKRNG003] were reported as non-detect (ND) with elevated reporting limits. Considering the location of these lysimeters in the K Range near the berm and the STAPP system; it is unlikely that nitroglycerin is present in these samples. However, the matrices of these samples had too much interference to confidently determine nitroglycerin to be non-detect at the reporting limit of 2 ug/L. The lysimeter sample results are presented in Tables 2, 5 and 8.

The lead, antimony and copper results from the groundwater samples collected from all ranges were less than the action levels of 5.0 µg/L, 2.0 µg/L and 434 µg/L, respectively. The action level for nitroglycerin in groundwater was 1.6 µg/L; the results for nitroglycerin in the groundwater samples from all ranges were non-detect at 2 µg/L with a method detection limit of 0.6 µg/L. The groundwater sample results are presented in Tables 3, 6 and 9.

The STAPP sample results are presented in Table 10.

The data are usable for project related decisions.

FIGURES


MW-473S
LYJRNG003
SSJRNG006
MW-471S
SSJRNG005
SSJRNG004
LYJRNG002
SSJRNG003
SSJRNG002
LYJRNG001
SSJRNG001
MW-472S
MW-474S
LEGEND
Lysimeter
Monitoring Well
Sampling Grid
STAPP System
Firing Line
LOCATION MAP
NOTES AND SOURCES
TITLE
J Range
MIS Sampling Grids
0
50
Feet
N
FIGURE
1


MW-473S
MW-471S
MW-472S
MW-474S
LYKRNG004
LYKRNG003
LYKRNG002
LYKRNG001
SSKRNG006
SSKRNG005
SSKRNG004
SSKRNG003
SSKRNG002
SSKRNG001
LEGEND
Lysimeter
Monitoring Well
Sampling Grid
STAPP System
Firing Line
LOCATION MAP
NOTES AND SOURCES
TITLE
K Range
MIS Sampling Grids
0
50
Feet
N
FIGURE
2


MW-467S
SSTRNGA1A
SSTRNGA1B
SSTRNGA1C
SSTRNGA1D
LYTRNG011
LYTRNG012
LYTRNG013
SSTRNGA1E
SSTRNGA2A
MW-469S
LEGEND
Monitoring Well
Lysimeter
Sampling Grid
STAPP System
Firing Line
LOCATION MAP
NOTES AND SOURCES
TITLE
T Range
MIS Sampling Grids
0
100
Feet
N
FIGURE
3

APPENDIX A
Data Tables

Table 1
J Range Validated Soil Data

Site ID	Location ID	Field Sample ID	Northing	Easting	Date Sampled	Test Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]	Sample Type
J RANGE	SSJRNG001	SSJRNG001_OCT11A	4616341.33	371958.87	10/13/2011	SW6020	Copper	20.3		MG/KG	0.0089	1.1	N1
J RANGE	SSJRNG001	SSJRNG001_OCT11A	4616341.33	371958.87	10/13/2011	SW6020	Lead	24.0		MG/KG	0.027	1.1	N1
J RANGE	SSJRNG001	SSJRNG001_OCT11A	4616341.33	371958.87	10/13/2011	SW6020	Zinc	39.1		MG/KG	0.61	11.2	N1
J RANGE	SSJRNG001	SSJRNG001_OCT11A	4616341.33	371958.87	10/13/2011	SW6020	Antimony	ND	U	MG/KG	0.0046	1.1	N1
J RANGE	SSJRNG001	SSJRNG001_OCT11A	4616341.33	371958.87	10/13/2011	SW6020	Tungsten	ND	U	MG/KG	0.028	0.22	N1
J RANGE	SSJRNG001	SSJRNG001_OCT11A	4616341.33	371958.87	10/13/2011	SW8330	Nitroglycerin	6980	J	UG/KG	611	2000	N1
J RANGE	SSJRNG001	SSJRNG001_OCT11B	4616341.33	371958.87	10/13/2011	SW6020	Copper	19.7		MG/KG	0.010	1.3	FR1
J RANGE	SSJRNG001	SSJRNG001_OCT11B	4616341.33	371958.87	10/13/2011	SW6020	Lead	21.3		MG/KG	0.031	1.3	FR1
J RANGE	SSJRNG001	SSJRNG001_OCT11B	4616341.33	371958.87	10/13/2011	SW6020	Zinc	37.3		MG/KG	0.71	13.0	FR1
J RANGE	SSJRNG001	SSJRNG001_OCT11B	4616341.33	371958.87	10/13/2011	SW6020	Antimony	ND	U	MG/KG	0.0053	1.3	FR1
J RANGE	SSJRNG001	SSJRNG001_OCT11B	4616341.33	371958.87	10/13/2011	SW6020	Tungsten	ND	U	MG/KG	0.032	0.26	FR1
J RANGE	SSJRNG001	SSJRNG001_OCT11B	4616341.33	371958.87	10/13/2011	SW8330	Nitroglycerin	11900		UG/KG	591	1930	FR1
J RANGE	SSJRNG001	SSJRNG001_OCT11C	4616341.33	371958.87	10/13/2011	SW6020	Lead	16.0		MG/KG	0.026	1.1	FR1
J RANGE	SSJRNG001	SSJRNG001_OCT11C	4616341.33	371958.87	10/13/2011	SW6020	Copper	21.3		MG/KG	0.0087	1.1	FR1
J RANGE	SSJRNG001	SSJRNG001_OCT11C	4616341.33	371958.87	10/13/2011	SW6020	Zinc	40.8		MG/KG	0.60	10.9	FR1
J RANGE	SSJRNG001	SSJRNG001_OCT11C	4616341.33	371958.87	10/13/2011	SW6020	Antimony	ND	U	MG/KG	0.0045	1.1	FR1
J RANGE	SSJRNG001	SSJRNG001_OCT11C	4616341.33	371958.87	10/13/2011	SW6020	Tungsten	ND	U	MG/KG	0.014	0.15	FR1
J RANGE	SSJRNG001	SSJRNG001_OCT11C	4616341.33	371958.87	10/13/2011	SW8330	Nitroglycerin	10400		UG/KG	607	1980	FR1
J RANGE	SSJRNG002	SSJRNG002_OCT11A	4616345.37	371959.24	10/13/2011	SW6020	Zinc	22.2		MG/KG	0.057	1.0	N1
J RANGE	SSJRNG002	SSJRNG002_OCT11A	4616345.37	371959.24	10/13/2011	SW6020	Lead	62.3		MG/KG	0.025	1.0	N1
J RANGE	SSJRNG002	SSJRNG002_OCT11A	4616345.37	371959.24	10/13/2011	SW6020	Antimony	ND	U	MG/KG	0.0042	1.0	N1
J RANGE	SSJRNG002	SSJRNG002_OCT11A	4616345.37	371959.24	10/13/2011	SW6020	Copper	ND	U	MG/KG	0.0083	9.2	N1
J RANGE	SSJRNG002	SSJRNG002_OCT11A	4616345.37	371959.24	10/13/2011	SW6020	Tungsten	ND	U	MG/KG	0.013	0.11	N1
J RANGE	SSJRNG002	SSJRNG002_OCT11A	4616345.37	371959.24	10/13/2011	SW8330	Nitroglycerin	2090	J	UG/KG	585	1910	N1
J RANGE	SSJRNG003	SSJRNG003_OCT11A	4616350.92	371959.2	10/13/2011	SW6020	Lead	106		MG/KG	0.16	6.8	N1
J RANGE	SSJRNG003	SSJRNG003_OCT11A	4616350.92	371959.2	10/13/2011	SW6020	Zinc	18.6		MG/KG	0.074	1.4	N1
J RANGE	SSJRNG003	SSJRNG003_OCT11A	4616350.92	371959.2	10/13/2011	SW6020	Antimony	ND	U	MG/KG	0.0055	1.4	N1
J RANGE	SSJRNG003	SSJRNG003_OCT11A	4616350.92	371959.2	10/13/2011	SW6020	Copper	ND	U	MG/KG	0.011	7.7	N1
J RANGE	SSJRNG003	SSJRNG003_OCT11A	4616350.92	371959.2	10/13/2011	SW6020	Tungsten	ND	U	MG/KG	0.017	0.14	N1
J RANGE	SSJRNG003	SSJRNG003_OCT11A	4616350.92	371959.2	10/13/2011	SW8330	Nitroglycerin	1600	J	UG/KG	609	1990	N1
J RANGE	SSJRNG003	SSJRNG003_OCT11B	4616350.92	371959.2	10/13/2011	SW6020	Zinc	23.0		MG/KG	0.059	1.1	FR1
J RANGE	SSJRNG003	SSJRNG003_OCT11B	4616350.92	371959.2	10/13/2011	SW6020	Lead	53.5		MG/KG	0.13	5.4	FR1
J RANGE	SSJRNG003	SSJRNG003_OCT11B	4616350.92	371959.2	10/13/2011	SW6020	Antimony	ND	U	MG/KG	0.0044	1.1	FR1
J RANGE	SSJRNG003	SSJRNG003_OCT11B	4616350.92	371959.2	10/13/2011	SW6020	Copper	ND	U	MG/KG	0.0086	9.6	FR1
J RANGE	SSJRNG003	SSJRNG003_OCT11B	4616350.92	371959.2	10/13/2011	SW6020	Tungsten	ND	U	MG/KG	0.013	0.11	FR1
J RANGE	SSJRNG003	SSJRNG003_OCT11B	4616350.92	371959.2	10/13/2011	SW8330	Nitroglycerin	2450	J	UG/KG	609	1990	FR1
J RANGE	SSJRNG003	SSJRNG003_OCT11C	4616350.92	371959.2	10/13/2011	SW6020	Zinc	22.6		MG/KG	0.072	1.3	FR1
J RANGE	SSJRNG003	SSJRNG003_OCT11C	4616350.92	371959.2	10/13/2011	SW6020	Lead	54.5		MG/KG	0.032	1.3	FR1
J RANGE	SSJRNG003	SSJRNG003_OCT11C	4616350.92	371959.2	10/13/2011	SW6020	Antimony	ND	U	MG/KG	0.0054	1.3	FR1
J RANGE	SSJRNG003	SSJRNG003_OCT11C	4616350.92	371959.2	10/13/2011	SW6020	Copper	ND	U	MG/KG	0.011	9.9	FR1

Tables1,4,7_JKTRangeSoilDataTables.xlsx

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Table 1
J Range Validated Soil Data

Site ID	Location ID	Field Sample ID	Northing	Easting	Date Sampled	Test Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]	Sample Type
J RANGE	SSJRNG003	SSJRNG003_OCT11C	4616350.92	371959.2	10/13/2011	SW6020	Tungsten	ND	U	MG/KG	0.016	0.13	FR1
J RANGE	SSJRNG003	SSJRNG003_OCT11C	4616350.92	371959.2	10/13/2011	SW8330	Nitroglycerin	2290	J	UG/KG	591	1930	FR1
J RANGE	SSJRNG004	SSJRNG004_OCT11A	4616356.64	371959.22	10/13/2011	SW6020	Zinc	22.2		MG/KG	0.056	1.0	N1
J RANGE	SSJRNG004	SSJRNG004_OCT11A	4616356.64	371959.22	10/13/2011	SW6020	Lead	57.9		MG/KG	0.025	1.0	N1
J RANGE	SSJRNG004	SSJRNG004_OCT11A	4616356.64	371959.22	10/13/2011	SW6020	Antimony	ND	U	MG/KG	0.0042	1.0	N1
J RANGE	SSJRNG004	SSJRNG004_OCT11A	4616356.64	371959.22	10/13/2011	SW6020	Copper	ND	U	MG/KG	0.0082	9.4	N1
J RANGE	SSJRNG004	SSJRNG004_OCT11A	4616356.64	371959.22	10/13/2011	SW6020	Tungsten	ND	U	MG/KG	0.013	0.11	N1
J RANGE	SSJRNG004	SSJRNG004_OCT11A	4616356.64	371959.22	10/13/2011	SW8330	Nitroglycerin	3390	J	UG/KG	600	1960	N1
J RANGE	SSJRNG005	SSJRNG005_OCT11A	4616362.08	371959.17	10/13/2011	SW6020	Zinc	23.2		MG/KG	0.067	1.2	N1
J RANGE	SSJRNG005	SSJRNG005_OCT11A	4616362.08	371959.17	10/13/2011	SW6020	Lead	76.5		MG/KG	0.15	6.1	N1
J RANGE	SSJRNG005	SSJRNG005_OCT11A	4616362.08	371959.17	10/13/2011	SW6020	Antimony	ND	U	MG/KG	0.0050	1.2	N1
J RANGE	SSJRNG005	SSJRNG005_OCT11A	4616362.08	371959.17	10/13/2011	SW6020	Copper	ND	U	MG/KG	0.0098	10.3	N1
J RANGE	SSJRNG005	SSJRNG005_OCT11A	4616362.08	371959.17	10/13/2011	SW6020	Tungsten	ND	U	MG/KG	0.015	0.12	N1
J RANGE	SSJRNG005	SSJRNG005_OCT11A	4616362.08	371959.17	10/13/2011	SW8330	Nitroglycerin	1730	J	UG/KG	572	1870	N1
J RANGE	SSJRNG005	SSJRNG005_OCT11B	4616362.08	371959.17	10/13/2011	SW6020	Zinc	25.7		MG/KG	0.069	1.3	FR1
J RANGE	SSJRNG005	SSJRNG005_OCT11B	4616362.08	371959.17	10/13/2011	SW6020	Lead	45.7		MG/KG	0.030	1.3	FR1
J RANGE	SSJRNG005	SSJRNG005_OCT11B	4616362.08	371959.17	10/13/2011	SW6020	Antimony	ND	U	MG/KG	0.0052	1.3	FR1
J RANGE	SSJRNG005	SSJRNG005_OCT11B	4616362.08	371959.17	10/13/2011	SW6020	Copper	ND	U	MG/KG	0.010	9.3	FR1
J RANGE	SSJRNG005	SSJRNG005_OCT11B	4616362.08	371959.17	10/13/2011	SW6020	Tungsten	ND	U	MG/KG	0.016	0.15	FR1
J RANGE	SSJRNG005	SSJRNG005_OCT11B	4616362.08	371959.17	10/13/2011	SW8330	Nitroglycerin	2020	J	UG/KG	577	1890	FR1
J RANGE	SSJRNG005	SSJRNG005_OCT11C	4616362.08	371959.17	10/13/2011	SW6020	Zinc	23.0		MG/KG	0.061	1.1	FR1
J RANGE	SSJRNG005	SSJRNG005_OCT11C	4616362.08	371959.17	10/13/2011	SW6020	Lead	47.8		MG/KG	0.027	1.1	FR1
J RANGE	SSJRNG005	SSJRNG005_OCT11C	4616362.08	371959.17	10/13/2011	SW6020	Antimony	ND	U	MG/KG	0.0046	1.1	FR1
J RANGE	SSJRNG005	SSJRNG005_OCT11C	4616362.08	371959.17	10/13/2011	SW6020	Copper	ND	U	MG/KG	0.0089	8.6	FR1
J RANGE	SSJRNG005	SSJRNG005_OCT11C	4616362.08	371959.17	10/13/2011	SW6020	Tungsten	ND	U	MG/KG	0.014	0.11	FR1
J RANGE	SSJRNG005	SSJRNG005_OCT11C	4616362.08	371959.17	10/13/2011	SW8330	Nitroglycerin	2100	J	UG/KG	618	2020	FR1
J RANGE	SSJRNG006	SSJRNG006_OCT11A	4616366.26	371958.99	10/13/2011	SW6020	Zinc	25.8		MG/KG	0.064	1.2	N1
J RANGE	SSJRNG006	SSJRNG006_OCT11A	4616366.26	371958.99	10/13/2011	SW6020	Lead	34.5		MG/KG	0.028	1.2	N1
J RANGE	SSJRNG006	SSJRNG006_OCT11A	4616366.26	371958.99	10/13/2011	SW6020	Antimony	ND	U	MG/KG	0.0048	1.2	N1
J RANGE	SSJRNG006	SSJRNG006_OCT11A	4616366.26	371958.99	10/13/2011	SW6020	Copper	ND	U	MG/KG	0.0094	8.8	N1
J RANGE	SSJRNG006	SSJRNG006_OCT11A	4616366.26	371958.99	10/13/2011	SW6020	Tungsten	ND	U	MG/KG	0.029	0.23	N1

Notes:

[1] Qualifiers: U = Non-detect. J = Value is estimated less than the reporting limit or due to limitation identified in the data validation.

[2] MDL = Method Detection Limit

[3] RL = Reporting Limit

Tables1,4,7_JKTRangeSoilDataTables.xlsx

Table 2
J Range Validated Lysimeter Data

Site ID	Location ID	Field Sample ID	Northing	Easting	Date Sampled	Test Method	Extraction Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]
J RANGE	LYJRNG001	LYJRNG001_OCT11FA	4616347.89	371959.96	10/12/2011	SW6020	FLDFLT	Copper	1.0	J	UG/L	0.23	20.0
J RANGE	LYJRNG001	LYJRNG001_OCT11FA	4616347.89	371959.96	10/12/2011	SW6020	FLDFLT	Zinc	2.3	J	UG/L	0.50	20.0
J RANGE	LYJRNG001	LYJRNG001_OCT11FA	4616347.89	371959.96	10/12/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	0.073	20.0
J RANGE	LYJRNG001	LYJRNG001_OCT11FA	4616347.89	371959.96	10/12/2011	SW6020	FLDFLT	Lead	ND	U	UG/L	0.024	2.0
J RANGE	LYJRNG001	LYJRNG001_OCT11UA	4616347.89	371959.96	10/12/2011	SW6020	TOTAL	Copper	1.7	J	UG/L	0.23	20.0
J RANGE	LYJRNG001	LYJRNG001_OCT11UA	4616347.89	371959.96	10/12/2011	SW6020	TOTAL	Zinc	3.2	J	UG/L	0.50	20.0
J RANGE	LYJRNG001	LYJRNG001_OCT11UA	4616347.89	371959.96	10/12/2011	SW6020	TOTAL	Lead	5.5		UG/L	0.024	2.0
J RANGE	LYJRNG001	LYJRNG001_OCT11UA	4616347.89	371959.96	10/12/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	0.073	20.0
J RANGE	LYJRNG001	LYJRNG001_OCT11UA	4616347.89	371959.96	10/12/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.16	2.0
J RANGE	LYJRNG001	LYJRNG001_OCT11UA	4616347.89	371959.96	10/12/2011	SW8330	METHOD	Nitroglycerin	ND	U	UG/L	0.57	1.9
J RANGE	LYJRNG002	LYJRNG002_OCT11FA	4616355.88	371960.05	10/12/2011	SW6020	FLDFLT	Copper	2.6	J	UG/L	0.23	20.0
J RANGE	LYJRNG002	LYJRNG002_OCT11FA	4616355.88	371960.05	10/12/2011	SW6020	FLDFLT	Zinc	3.8	J	UG/L	0.50	20.0
J RANGE	LYJRNG002	LYJRNG002_OCT11FA	4616355.88	371960.05	10/12/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	0.073	20.0
J RANGE	LYJRNG002	LYJRNG002_OCT11FA	4616355.88	371960.05	10/12/2011	SW6020	FLDFLT	Lead	ND	U	UG/L	0.024	2.0
J RANGE	LYJRNG002	LYJRNG002_OCT11UA	4616355.88	371960.05	10/12/2011	SW6020	TOTAL	Copper	1.2	J	UG/L	0.23	20.0
J RANGE	LYJRNG002	LYJRNG002_OCT11UA	4616355.88	371960.05	10/12/2011	SW6020	TOTAL	Lead	2.8		UG/L	0.024	2.0
J RANGE	LYJRNG002	LYJRNG002_OCT11UA	4616355.88	371960.05	10/12/2011	SW6020	TOTAL	Zinc	3.2	J	UG/L	0.50	20.0
J RANGE	LYJRNG002	LYJRNG002_OCT11UA	4616355.88	371960.05	10/12/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	0.073	20.0
J RANGE	LYJRNG002	LYJRNG002_OCT11UA	4616355.88	371960.05	10/12/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.16	2.0
J RANGE	LYJRNG002	LYJRNG002_OCT11UA	4616355.88	371960.05	10/12/2011	SW8330	METHOD	Nitroglycerin	ND	U	UG/L	0.58	1.9
J RANGE	LYJRNG003	LYJRNG003_OCT11FA	4616368	371939.92	10/11/2011	SW6020	FLDFLT	Zinc	5.8	J	UG/L	0.50	20.0
J RANGE	LYJRNG003	LYJRNG003_OCT11FA	4616368	371939.92	10/11/2011	SW6020	FLDFLT	Copper	6.2	J	UG/L	0.23	20.0
J RANGE	LYJRNG003	LYJRNG003_OCT11FA	4616368	371939.92	10/11/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	0.073	20.0
J RANGE	LYJRNG003	LYJRNG003_OCT11FA	4616368	371939.92	10/11/2011	SW6020	FLDFLT	Lead	ND	U	UG/L	0.024	2.0
J RANGE	LYJRNG003	LYJRNG003_OCT11UA	4616368	371939.92	10/11/2011	SW6020	TOTAL	Zinc	0.88	J	UG/L	0.50	20.0
J RANGE	LYJRNG003	LYJRNG003_OCT11UA	4616368	371939.92	10/11/2011	SW6020	TOTAL	Copper	4.7	J	UG/L	0.23	20.0
J RANGE	LYJRNG003	LYJRNG003_OCT11UA	4616368	371939.92	10/11/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	0.073	20.0
J RANGE	LYJRNG003	LYJRNG003_OCT11UA	4616368	371939.92	10/11/2011	SW6020	TOTAL	Lead	ND	U	UG/L	0.024	2.0
J RANGE	LYJRNG003	LYJRNG003_OCT11UA	4616368	371939.92	10/11/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.16	2.0
J RANGE	LYJRNG003	LYJRNG003_OCT11UA	4616368	371939.92	10/11/2011	SW8330	METHOD	Nitroglycerin	ND	UJ	UG/L	0.57	3.1

Notes:

[1] Qualifiers: U = Non-detect. J = Value is estimated less than the reporting limit. UJ = The analyte was not detected above this value and is estimated due to matrix interferences.

[2] MDL = Method Detection Limit

[3] RL = Reporting Limit

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Table 3
J Range Validated Groundwater Data

Site ID	Location ID	Field Sample ID	Top depth (ft bgs)	Bottom Depth (ft bgs)	Date Sampled	Test Method	Extraction Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]
J RANGE	MW-471S	MW-471S_OCT11FA	84.59	94.59	10/06/2011	SW6020	FLDFLT	Copper	7.3	J	UG/L	0.23	20.0
J RANGE	MW-471S	MW-471S_OCT11FA	84.59	94.59	10/06/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	0.073	20.0
J RANGE	MW-471S	MW-471S_OCT11FA	84.59	94.59	10/06/2011	SW6020	FLDFLT	Lead	ND	U	UG/L	0.024	2.0
J RANGE	MW-471S	MW-471S_OCT11FA	84.59	94.59	10/06/2011	SW6020	FLDFLT	Zinc	ND	U	UG/L	0.50	20.0
J RANGE	MW-471S	MW-471S_OCT11UA	84.59	94.59	10/06/2011	SW6020	TOTAL	Copper	3.3	J	UG/L	0.23	20.0
J RANGE	MW-471S	MW-471S_OCT11UA	84.59	94.59	10/06/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	0.073	20.0
J RANGE	MW-471S	MW-471S_OCT11UA	84.59	94.59	10/06/2011	SW6020	TOTAL	Lead	ND	U	UG/L	0.024	2.0
J RANGE	MW-471S	MW-471S_OCT11UA	84.59	94.59	10/06/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.16	2.0
J RANGE	MW-471S	MW-471S_OCT11UA	84.59	94.59	10/06/2011	SW6020	TOTAL	Zinc	ND	U	UG/L	0.50	20.0
J RANGE	MW-471S	MW-471S_OCT11UA	84.59	94.59	10/06/2011	SW8330	METHOD	Nitroglycerin	ND	U	UG/L	0.57	1.9
J RANGE	MW-472S	MW-472S_OCT11FA	85.31	95.31	10/05/2011	SW6020	FLDFLT	Copper	0.27	J	UG/L	0.23	20.0
J RANGE	MW-472S	MW-472S_OCT11FA	85.31	95.31	10/05/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	0.073	20.0
J RANGE	MW-472S	MW-472S_OCT11FA	85.31	95.31	10/05/2011	SW6020	FLDFLT	Lead	ND	U	UG/L	0.024	2.0
J RANGE	MW-472S	MW-472S_OCT11FA	85.31	95.31	10/05/2011	SW6020	FLDFLT	Zinc	ND	U	UG/L	0.50	20.0
J RANGE	MW-472S	MW-472S_OCT11UA	85.31	95.31	10/05/2011	SW6020	TOTAL	Copper	1.0	J	UG/L	0.23	20.0
J RANGE	MW-472S	MW-472S_OCT11UA	85.31	95.31	10/05/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	0.073	20.0
J RANGE	MW-472S	MW-472S_OCT11UA	85.31	95.31	10/05/2011	SW6020	TOTAL	Lead	ND	U	UG/L	0.024	2.0
J RANGE	MW-472S	MW-472S_OCT11UA	85.31	95.31	10/05/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.16	2.0
J RANGE	MW-472S	MW-472S_OCT11UA	85.31	95.31	10/05/2011	SW6020	TOTAL	Zinc	ND	U	UG/L	0.50	20.0
J RANGE	MW-472S	MW-472S_OCT11UA	85.31	95.31	10/05/2011	SW8330	METHOD	Nitroglycerin	ND	U	UG/L	0.57	1.9

Notes:

[1] Qualifiers: U = Non-detect. J = Value is estimated less than the reporting limit.

[2] MDL = Method Detection Limit

[3] RL = Reporting Limit

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Table 4
K Range Validated Soil Data

Site ID	Location ID	Field Sample ID	Northing	Easting	Date Sampled	Test Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]	Sample Type
K RANGE	SSKRNG001	SSKRNG001_OCT11A	4616341.71	372041.94	10/14/2011	SW6020	Lead	12.1		MG/KG	0.024	1.0	N1
K RANGE	SSKRNG001	SSKRNG001_OCT11A	4616341.71	372041.94	10/14/2011	SW6020	Copper	27.6		MG/KG	0.0081	1.0	N1
K RANGE	SSKRNG001	SSKRNG001_OCT11A	4616341.71	372041.94	10/14/2011	SW6020	Zinc	37.1		MG/KG	0.56	10.1	N1
K RANGE	SSKRNG001	SSKRNG001_OCT11A	4616341.71	372041.94	10/14/2011	SW6020	Antimony	ND	U	MG/KG	0.0041	1.0	N1
K RANGE	SSKRNG001	SSKRNG001_OCT11A	4616341.71	372041.94	10/14/2011	SW6020	Tungsten	ND	U	MG/KG	0.013	0.10	N1
K RANGE	SSKRNG001	SSKRNG001_OCT11A	4616341.71	372041.94	10/14/2011	SW8330	Nitroglycerin	11800		UG/KG	587	1920	N1
K RANGE	SSKRNG001	SSKRNG001_OCT11B	4616341.71	372041.94	10/14/2011	SW6020	Lead	15.2		MG/KG	0.027	1.1	FR1
K RANGE	SSKRNG001	SSKRNG001_OCT11B	4616341.71	372041.94	10/14/2011	SW6020	Copper	25.1		MG/KG	0.0091	1.1	FR1
K RANGE	SSKRNG001	SSKRNG001_OCT11B	4616341.71	372041.94	10/14/2011	SW6020	Zinc	36.8		MG/KG	0.63	11.4	FR1
K RANGE	SSKRNG001	SSKRNG001_OCT11B	4616341.71	372041.94	10/14/2011	SW6020	Antimony	ND	U	MG/KG	0.0047	1.1	FR1
K RANGE	SSKRNG001	SSKRNG001_OCT11B	4616341.71	372041.94	10/14/2011	SW6020	Tungsten	ND	U	MG/KG	0.014	0.11	FR1
K RANGE	SSKRNG001	SSKRNG001_OCT11B	4616341.71	372041.94	10/14/2011	SW8330	Nitroglycerin	21100		UG/KG	608	1990	FR1
K RANGE	SSKRNG001	SSKRNG001_OCT11C	4616341.71	372041.94	10/14/2011	SW6020	Lead	15.5		MG/KG	0.028	1.2	FR1
K RANGE	SSKRNG001	SSKRNG001_OCT11C	4616341.71	372041.94	10/14/2011	SW6020	Copper	25.2		MG/KG	0.0094	1.2	FR1
K RANGE	SSKRNG001	SSKRNG001_OCT11C	4616341.71	372041.94	10/14/2011	SW6020	Zinc	36.9		MG/KG	0.65	11.8	FR1
K RANGE	SSKRNG001	SSKRNG001_OCT11C	4616341.71	372041.94	10/14/2011	SW6020	Antimony	ND	U	MG/KG	0.0048	1.2	FR1
K RANGE	SSKRNG001	SSKRNG001_OCT11C	4616341.71	372041.94	10/14/2011	SW6020	Tungsten	ND	U	MG/KG	0.015	0.12	FR1
K RANGE	SSKRNG001	SSKRNG001_OCT11C	4616341.71	372041.94	10/14/2011	SW8330	Nitroglycerin	22400		UG/KG	587	1920	FR1
K RANGE	SSKRNG002	SSKRNG002_OCT11A	4616346.08	372042.19	10/14/2011	SW6020	Zinc	16.1		MG/KG	0.060	1.1	N1
K RANGE	SSKRNG002	SSKRNG002_OCT11A	4616346.08	372042.19	10/14/2011	SW6020	Lead	29.3		MG/KG	0.026	1.1	N1
K RANGE	SSKRNG002	SSKRNG002_OCT11A	4616346.08	372042.19	10/14/2011	SW6020	Antimony	ND	U	MG/KG	0.0045	1.1	N1
K RANGE	SSKRNG002	SSKRNG002_OCT11A	4616346.08	372042.19	10/14/2011	SW6020	Copper	ND	U	MG/KG	0.0088	9.2	N1
K RANGE	SSKRNG002	SSKRNG002_OCT11A	4616346.08	372042.19	10/14/2011	SW6020	Tungsten	ND	U	MG/KG	0.014	0.11	N1
K RANGE	SSKRNG002	SSKRNG002_OCT11A	4616346.08	372042.19	10/14/2011	SW8330	Nitroglycerin	2370	J	UG/KG	580	1900	N1
K RANGE	SSKRNG003	SSKRNG003_OCT11A	4616351.28	372042.4	10/18/2011	SW6020	Zinc	13.9		MG/KG	0.056	1.0	N1
K RANGE	SSKRNG003	SSKRNG003_OCT11A	4616351.28	372042.4	10/18/2011	SW6020	Lead	25.5		MG/KG	0.024	1.0	N1
K RANGE	SSKRNG003	SSKRNG003_OCT11A	4616351.28	372042.4	10/18/2011	SW6020	Copper	7.0		MG/KG	0.0081	1.0	N1
K RANGE	SSKRNG003	SSKRNG003_OCT11A	4616351.28	372042.4	10/18/2011	SW6020	Antimony	ND	U	MG/KG	0.0041	1.0	N1
K RANGE	SSKRNG003	SSKRNG003_OCT11A	4616351.28	372042.4	10/18/2011	SW6020	Tungsten	ND	U	MG/KG	0.013	0.11	N1
K RANGE	SSKRNG003	SSKRNG003_OCT11A	4616351.28	372042.4	10/18/2011	SW8330	Nitroglycerin	2230	J	UG/KG	600	1960	N1
K RANGE	SSKRNG003	SSKRNG003_OCT11B	4616351.28	372042.4	10/18/2011	SW6020	Zinc	16.8		MG/KG	0.15	2.7	FR1
K RANGE	SSKRNG003	SSKRNG003_OCT11B	4616351.28	372042.4	10/18/2011	SW6020	Lead	29.6		MG/KG	0.032	1.3	FR1
K RANGE	SSKRNG003	SSKRNG003_OCT11B	4616351.28	372042.4	10/18/2011	SW6020	Copper	9.5		MG/KG	0.021	2.7	FR1
K RANGE	SSKRNG003	SSKRNG003_OCT11B	4616351.28	372042.4	10/18/2011	SW6020	Antimony	ND	U	MG/KG	0.0055	1.3	FR1
K RANGE	SSKRNG003	SSKRNG003_OCT11B	4616351.28	372042.4	10/18/2011	SW6020	Tungsten	ND	U	MG/KG	0.017	0.13	FR1
K RANGE	SSKRNG003	SSKRNG003_OCT11B	4616351.28	372042.4	10/18/2011	SW8330	Nitroglycerin	2710	J	UG/KG	571	1870	FR1
K RANGE	SSKRNG003	SSKRNG003_OCT11C	4616351.28	372042.4	10/18/2011	SW6020	Zinc	17.1		MG/KG	0.15	2.7	FR1
K RANGE	SSKRNG003	SSKRNG003_OCT11C	4616351.28	372042.4	10/18/2011	SW6020	Lead	26.3		MG/KG	0.033	1.4	FR1
K RANGE	SSKRNG003	SSKRNG003_OCT11C	4616351.28	372042.4	10/18/2011	SW6020	Copper	9.1		MG/KG	0.022	2.7	FR1
K RANGE	SSKRNG003	SSKRNG003_OCT11C	4616351.28	372042.4	10/18/2011	SW6020	Antimony	ND	U	MG/KG	0.0056	1.4	FR1
K RANGE	SSKRNG003	SSKRNG003_OCT11C	4616351.28	372042.4	10/18/2011	SW6020	Tungsten	ND	U	MG/KG	0.017	0.14	FR1
K RANGE	SSKRNG003	SSKRNG003_OCT11C	4616351.28	372042.4	10/18/2011	SW8330	Nitroglycerin	2330	J	UG/KG	602	1970	FR1

Table 4
K Range Validated Soil Data

Site ID	Location ID	Field Sample ID	Northing	Easting	Date Sampled	Test Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]	Sample Type
K RANGE	SSKRNG004	SSKRNG004_OCT11A	4616355.92	372042.55	10/18/2011	SW6020	Zinc	17.1		MG/KG	0.14	2.5	N1
K RANGE	SSKRNG004	SSKRNG004_OCT11A	4616355.92	372042.55	10/18/2011	SW6020	Lead	34.4		MG/KG	0.030	1.3	N1
K RANGE	SSKRNG004	SSKRNG004_OCT11A	4616355.92	372042.55	10/18/2011	SW6020	Copper	9.9		MG/KG	0.020	2.5	N1
K RANGE	SSKRNG004	SSKRNG004_OCT11A	4616355.92	372042.55	10/18/2011	SW6020	Antimony	ND	U	MG/KG	0.0052	1.3	N1
K RANGE	SSKRNG004	SSKRNG004_OCT11A	4616355.92	372042.55	10/18/2011	SW6020	Tungsten	ND	U	MG/KG	0.016	0.13	N1
K RANGE	SSKRNG004	SSKRNG004_OCT11A	4616355.92	372042.55	10/18/2011	SW8330	Nitroglycerin	2750	J	UG/KG	619	2020	N1
K RANGE	SSKRNG005	SSKRNG005_OCT11A	4616362	372042.36	10/20/2011	SW6020	Zinc	13.9		MG/KG	0.057	1.0	N1
K RANGE	SSKRNG005	SSKRNG005_OCT11A	4616362	372042.36	10/20/2011	SW6020	Lead	34.3		MG/KG	0.049	2.1	N1
K RANGE	SSKRNG005	SSKRNG005_OCT11A	4616362	372042.36	10/20/2011	SW6020	Antimony	ND	U	MG/KG	0.0042	1.0	N1
K RANGE	SSKRNG005	SSKRNG005_OCT11A	4616362	372042.36	10/20/2011	SW6020	Copper	ND	U	MG/KG	0.0082	7.8	N1
K RANGE	SSKRNG005	SSKRNG005_OCT11A	4616362	372042.36	10/20/2011	SW6020	Tungsten	ND	U	MG/KG	0.013	0.11	N1
K RANGE	SSKRNG005	SSKRNG005_OCT11A	4616362	372042.36	10/20/2011	SW8330	Nitroglycerin	2360	J	UG/KG	608	1990	N1
K RANGE	SSKRNG005	SSKRNG005_OCT11B	4616362	372042.36	10/20/2011	SW6020	Zinc	13.8		MG/KG	0.056	1.0	FR1
K RANGE	SSKRNG005	SSKRNG005_OCT11B	4616362	372042.36	10/20/2011	SW6020	Lead	34.7		MG/KG	0.048	2.0	FR1
K RANGE	SSKRNG005	SSKRNG005_OCT11B	4616362	372042.36	10/20/2011	SW6020	Antimony	ND	U	MG/KG	0.0041	1.0	FR1
K RANGE	SSKRNG005	SSKRNG005_OCT11B	4616362	372042.36	10/20/2011	SW6020	Copper	ND	U	MG/KG	0.0081	7.6	FR1
K RANGE	SSKRNG005	SSKRNG005_OCT11B	4616362	372042.36	10/20/2011	SW6020	Tungsten	ND	U	MG/KG	0.013	0.10	FR1
K RANGE	SSKRNG005	SSKRNG005_OCT11B	4616362	372042.36	10/20/2011	SW8330	Nitroglycerin	2240	J	UG/KG	608	1990	FR1
K RANGE	SSKRNG005	SSKRNG005_OCT11C	4616362	372042.36	10/20/2011	SW6020	Zinc	15.0		MG/KG	0.080	1.4	FR1
K RANGE	SSKRNG005	SSKRNG005_OCT11C	4616362	372042.36	10/20/2011	SW6020	Lead	30.8		MG/KG	0.035	1.4	FR1
K RANGE	SSKRNG005	SSKRNG005_OCT11C	4616362	372042.36	10/20/2011	SW6020	Antimony	ND	U	MG/KG	0.0059	1.4	FR1
K RANGE	SSKRNG005	SSKRNG005_OCT11C	4616362	372042.36	10/20/2011	SW6020	Copper	ND	U	MG/KG	0.012	9.5	FR1
K RANGE	SSKRNG005	SSKRNG005_OCT11C	4616362	372042.36	10/20/2011	SW6020	Tungsten	ND	U	MG/KG	0.018	0.14	FR1
K RANGE	SSKRNG005	SSKRNG005_OCT11C	4616362	372042.36	10/20/2011	SW8330	Nitroglycerin	2300	J	UG/KG	577	1890	FR1
K RANGE	SSKRNG006	SSKRNG006_OCT11A	4616366.35	372042.95	10/20/2011	SW6020	Zinc	22.2		MG/KG	0.15	2.7	N1
K RANGE	SSKRNG006	SSKRNG006_OCT11A	4616366.35	372042.95	10/20/2011	SW6020	Lead	35.5		MG/KG	0.32	13.3	N1
K RANGE	SSKRNG006	SSKRNG006_OCT11A	4616366.35	372042.95	10/20/2011	SW6020	Antimony	ND	U	MG/KG	0.0055	1.3	N1
K RANGE	SSKRNG006	SSKRNG006_OCT11A	4616366.35	372042.95	10/20/2011	SW6020	Copper	ND	U	MG/KG	0.021	9.7	N1
K RANGE	SSKRNG006	SSKRNG006_OCT11A	4616366.35	372042.95	10/20/2011	SW6020	Tungsten	ND	U	MG/KG	0.017	0.13	N1

Notes:
[1] Qualifiers: U = Non-detect. J = Value is estimated less than the reporting limit or due to limitation identified in the data validation.
[2] MDL = Method Detection Limit
[3] RL = Reporting Limit

Table 5
K Range Validated Lysimeter Data

Site ID	Location ID	Field Sample ID	Northing	Easting	Date Sampled	Test Method	Extraction Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]
K RANGE	LYKRNG001	LYKRNG001_OCT11FA	4616348.28	372042.38	10/12/2011	SW6020	FLDFLT	Zinc	10.3	J	UG/L	0.50	20.0
K RANGE	LYKRNG001	LYKRNG001_OCT11FA	4616348.28	372042.38	10/12/2011	SW6020	FLDFLT	Copper	2.9	J	UG/L	0.23	20.0
K RANGE	LYKRNG001	LYKRNG001_OCT11FA	4616348.28	372042.38	10/12/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	0.073	20.0
K RANGE	LYKRNG001	LYKRNG001_OCT11FA	4616348.28	372042.38	10/12/2011	SW6020	FLDFLT	Lead	ND	U	UG/L	0.024	2.0
K RANGE	LYKRNG001	LYKRNG001_OCT11UA	4616348.28	372042.38	10/12/2011	SW6020	TOTAL	Copper	0.87	J	UG/L	0.23	20.0
K RANGE	LYKRNG001	LYKRNG001_OCT11UA	4616348.28	372042.38	10/12/2011	SW6020	TOTAL	Zinc	2.5	J	UG/L	0.50	20.0
K RANGE	LYKRNG001	LYKRNG001_OCT11UA	4616348.28	372042.38	10/12/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	0.073	20.0
K RANGE	LYKRNG001	LYKRNG001_OCT11UA	4616348.28	372042.38	10/12/2011	SW6020	TOTAL	Lead	ND	U	UG/L	0.024	2.0
K RANGE	LYKRNG001	LYKRNG001_OCT11UA	4616348.28	372042.38	10/12/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.16	2.0
K RANGE	LYKRNG001	LYKRNG001_OCT11UA	4616348.28	372042.38	10/21/2011	SW8330	METHOD	Nitroglycerin	ND	U	UG/L	0.60	2.0
K RANGE	LYKRNG002	LYKRNG002_OCT11FA	4616355.95	372042.03	10/12/2011	SW6020	FLDFLT	Copper	0.88	J	UG/L	0.23	20.0
K RANGE	LYKRNG002	LYKRNG002_OCT11FA	4616355.95	372042.03	10/12/2011	SW6020	FLDFLT	Zinc	1.8	J	UG/L	0.50	20.0
K RANGE	LYKRNG002	LYKRNG002_OCT11FA	4616355.95	372042.03	10/12/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	0.073	20.0
K RANGE	LYKRNG002	LYKRNG002_OCT11FA	4616355.95	372042.03	10/12/2011	SW6020	FLDFLT	Lead	ND	U	UG/L	0.024	2.0
K RANGE	LYKRNG002	LYKRNG002_OCT11UA	4616355.95	372042.03	10/12/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	0.073	20.0
K RANGE	LYKRNG002	LYKRNG002_OCT11UA	4616355.95	372042.03	10/12/2011	SW6020	TOTAL	Copper	ND	U	UG/L	0.23	20.0
K RANGE	LYKRNG002	LYKRNG002_OCT11UA	4616355.95	372042.03	10/12/2011	SW6020	TOTAL	Lead	ND	U	UG/L	0.024	2.0
K RANGE	LYKRNG002	LYKRNG002_OCT11UA	4616355.95	372042.03	10/12/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.16	2.0
K RANGE	LYKRNG002	LYKRNG002_OCT11UA	4616355.95	372042.03	10/12/2011	SW6020	TOTAL	Zinc	ND	U	UG/L	0.50	20.0
K RANGE	LYKRNG002	LYKRNG002_OCT11UA	4616355.95	372042.03	10/12/2011	SW8330	METHOD	Nitroglycerin	ND	U	UG/L	0.58	1.9
K RANGE	LYKRNG003	LYKRNG003_OCT11FA	4616367.5	372076.56	10/12/2011	SW6020	FLDFLT	Copper	1.6	J	UG/L	0.23	20.0
K RANGE	LYKRNG003	LYKRNG003_OCT11FA	4616367.5	372076.56	10/12/2011	SW6020	FLDFLT	Lead	2.2		UG/L	0.024	2.0
K RANGE	LYKRNG003	LYKRNG003_OCT11FA	4616367.5	372076.56	10/12/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	0.073	20.0
K RANGE	LYKRNG003	LYKRNG003_OCT11FA	4616367.5	372076.56	10/12/2011	SW6020	FLDFLT	Zinc	ND	U	UG/L	0.50	20.0
K RANGE	LYKRNG003	LYKRNG003_OCT11UA	4616367.5	372076.56	10/12/2011	SW6020	TOTAL	Copper	1.4	J	UG/L	0.23	20.0
K RANGE	LYKRNG003	LYKRNG003_OCT11UA	4616367.5	372076.56	10/12/2011	SW6020	TOTAL	Lead	2.3		UG/L	0.024	2.0
K RANGE	LYKRNG003	LYKRNG003_OCT11UA	4616367.5	372076.56	10/12/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	0.073	20.0
K RANGE	LYKRNG003	LYKRNG003_OCT11UA	4616367.5	372076.56	10/12/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.16	2.0
K RANGE	LYKRNG003	LYKRNG003_OCT11UA	4616367.5	372076.56	10/12/2011	SW6020	TOTAL	Zinc	ND	U	UG/L	0.50	20.0
K RANGE	LYKRNG003	LYKRNG003_OCT11UA	4616367.5	372076.56	10/12/2011	SW8330	METHOD	Nitroglycerin	ND	UJ	UG/L	0.59	12.1
K RANGE	LYKRNG004	LYKRNG004_OCT11FA	4616367.19	372011.16	10/12/2011	SW6020	FLDFLT	Zinc	2.7	J	UG/L	0.50	20.0
K RANGE	LYKRNG004	LYKRNG004_OCT11FA	4616367.19	372011.16	10/12/2011	SW6020	FLDFLT	Lead	4.1		UG/L	0.024	2.0
K RANGE	LYKRNG004	LYKRNG004_OCT11FA	4616367.19	372011.16	10/12/2011	SW6020	FLDFLT	Copper	7.4	J	UG/L	0.23	20.0
K RANGE	LYKRNG004	LYKRNG004_OCT11FA	4616367.19	372011.16	10/12/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	0.073	20.0
K RANGE	LYKRNG004	LYKRNG004_OCT11FD	4616367.19	372011.16	10/12/2011	SW6020	FLDFLT	Lead	3.2		UG/L	0.024	2.0
K RANGE	LYKRNG004	LYKRNG004_OCT11FD	4616367.19	372011.16	10/12/2011	SW6020	FLDFLT	Zinc	4.9	J	UG/L	0.50	20.0
K RANGE	LYKRNG004	LYKRNG004_OCT11FD	4616367.19	372011.16	10/12/2011	SW6020	FLDFLT	Copper	6.0	J	UG/L	0.23	20.0
K RANGE	LYKRNG004	LYKRNG004_OCT11FD	4616367.19	372011.16	10/12/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	0.073	20.0
K RANGE	LYKRNG004	LYKRNG004_OCT11UA	4616367.19	372011.16	10/12/2011	SW6020	TOTAL	Zinc	1.6	J	UG/L	0.50	20.0
K RANGE	LYKRNG004	LYKRNG004_OCT11UA	4616367.19	372011.16	10/12/2011	SW6020	TOTAL	Lead	4.6		UG/L	0.024	2.0
K RANGE	LYKRNG004	LYKRNG004_OCT11UA	4616367.19	372011.16	10/12/2011	SW6020	TOTAL	Copper	6.4	J	UG/L	0.23	20.0
K RANGE	LYKRNG004	LYKRNG004_OCT11UA	4616367.19	372011.16	10/12/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	0.073	20.0

Table 5
K Range Validated Lysimeter Data

Site ID	Location ID	Field Sample ID	Northing	Easting	Date Sampled	Test Method	Extraction Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]
K RANGE	LYKRNG004	LYKRNG004_OCT11UA	4616367.19	372011.16	10/12/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.16	2.0
K RANGE	LYKRNG004	LYKRNG004_OCT11UA	4616367.19	372011.16	10/12/2011	SW8330	METHOD	Nitroglycerin	ND	UJ	UG/L	0.58	25.8
K RANGE	LYKRNG004	LYKRNG004_OCT11UD	4616367.19	372011.16	10/12/2011	SW6020	TOTAL	Zinc	3.9	J	UG/L	0.50	20.0
K RANGE	LYKRNG004	LYKRNG004_OCT11UD	4616367.19	372011.16	10/12/2011	SW6020	TOTAL	Lead	5.0		UG/L	0.024	2.0
K RANGE	LYKRNG004	LYKRNG004_OCT11UD	4616367.19	372011.16	10/12/2011	SW6020	TOTAL	Copper	6.4	J	UG/L	0.23	20.0
K RANGE	LYKRNG004	LYKRNG004_OCT11UD	4616367.19	372011.16	10/12/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	0.073	20.0
K RANGE	LYKRNG004	LYKRNG004_OCT11UD	4616367.19	372011.16	10/12/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.16	2.0
K RANGE	LYKRNG004	LYKRNG004_OCT11UD	4616367.19	372011.16	10/12/2011	SW8330	METHOD	Nitroglycerin	ND	UJ	UG/L	0.58	36.7

Notes:
[1] Qualifiers: U = Non-detect. J = Value is estimated less than the reporting limit. UJ = The analyte was not detected above this value and is estimated due to matrix interferences.
[2] MDL = Method Detection Limit
[3] RL = Reporting Limit

Table 6
K Range Validated Groundwater Data

Site ID	Location ID	Field Sample ID	Top depth (ft bgs)	Bottom Depth (ft bgs)	Date Sampled	Test Method	Extraction Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]
K RANGE	MW-473S	MW-473S_OCT11FA	83.38	93.38	10/05/2011	SW6020	FLDFLT	Copper	0.55	J	UG/L	0.23	20.0
K RANGE	MW-473S	MW-473S_OCT11FA	83.38	93.38	10/05/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	0.073	20.0
K RANGE	MW-473S	MW-473S_OCT11FA	83.38	93.38	10/05/2011	SW6020	FLDFLT	Lead	ND	U	UG/L	0.024	2.0
K RANGE	MW-473S	MW-473S_OCT11FA	83.38	93.38	10/05/2011	SW6020	FLDFLT	Zinc	ND	U	UG/L	0.50	20.0
K RANGE	MW-473S	MW-473S_OCT11FD	83.38	93.38	10/05/2011	SW6020	FLDFLT	Copper	0.31	J	UG/L	0.23	20.0
K RANGE	MW-473S	MW-473S_OCT11FD	83.38	93.38	10/05/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	0.073	20.0
K RANGE	MW-473S	MW-473S_OCT11FD	83.38	93.38	10/05/2011	SW6020	FLDFLT	Lead	ND	U	UG/L	0.024	2.0
K RANGE	MW-473S	MW-473S_OCT11FD	83.38	93.38	10/05/2011	SW6020	FLDFLT	Zinc	ND	U	UG/L	0.50	20.0
K RANGE	MW-473S	MW-473S_OCT11UA	83.38	93.38	10/05/2011	SW6020	TOTAL	Copper	0.31	J	UG/L	0.23	20.0
K RANGE	MW-473S	MW-473S_OCT11UA	83.38	93.38	10/05/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	0.073	20.0
K RANGE	MW-473S	MW-473S_OCT11UA	83.38	93.38	10/05/2011	SW6020	TOTAL	Lead	ND	U	UG/L	0.024	2.0
K RANGE	MW-473S	MW-473S_OCT11UA	83.38	93.38	10/05/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.16	2.0
K RANGE	MW-473S	MW-473S_OCT11UA	83.38	93.38	10/05/2011	SW6020	TOTAL	Zinc	ND	U	UG/L	0.50	20.0
K RANGE	MW-473S	MW-473S_OCT11UA	83.38	93.38	10/05/2011	SW8330	METHOD	Nitroglycerin	ND	U	UG/L	0.57	1.9
K RANGE	MW-473S	MW-473S_OCT11UD	83.38	93.38	10/05/2011	SW6020	TOTAL	Copper	0.24	J	UG/L	0.23	20.0
K RANGE	MW-473S	MW-473S_OCT11UD	83.38	93.38	10/05/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	0.073	20.0
K RANGE	MW-473S	MW-473S_OCT11UD	83.38	93.38	10/05/2011	SW6020	TOTAL	Lead	ND	U	UG/L	0.024	2.0
K RANGE	MW-473S	MW-473S_OCT11UD	83.38	93.38	10/05/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.16	2.0
K RANGE	MW-473S	MW-473S_OCT11UD	83.38	93.38	10/05/2011	SW6020	TOTAL	Zinc	ND	U	UG/L	0.50	20.0
K RANGE	MW-473S	MW-473S_OCT11UD	83.38	93.38	10/05/2011	SW8330	METHOD	Nitroglycerin	ND	U	UG/L	0.59	2.0
K RANGE	MW-474S	MW-474S_OCT11FA	86.44	96.44	10/05/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	0.073	20.0
K RANGE	MW-474S	MW-474S_OCT11FA	86.44	96.44	10/05/2011	SW6020	FLDFLT	Copper	ND	U	UG/L	0.23	20.0
K RANGE	MW-474S	MW-474S_OCT11FA	86.44	96.44	10/05/2011	SW6020	FLDFLT	Lead	ND	U	UG/L	0.024	2.0
K RANGE	MW-474S	MW-474S_OCT11FA	86.44	96.44	10/05/2011	SW6020	FLDFLT	Zinc	ND	U	UG/L	0.50	20.0
K RANGE	MW-474S	MW-474S_OCT11UA	86.44	96.44	10/05/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	0.073	20.0
K RANGE	MW-474S	MW-474S_OCT11UA	86.44	96.44	10/05/2011	SW6020	TOTAL	Copper	ND	U	UG/L	0.23	20.0
K RANGE	MW-474S	MW-474S_OCT11UA	86.44	96.44	10/05/2011	SW6020	TOTAL	Lead	ND	U	UG/L	0.024	2.0
K RANGE	MW-474S	MW-474S_OCT11UA	86.44	96.44	10/05/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.16	2.0
K RANGE	MW-474S	MW-474S_OCT11UA	86.44	96.44	10/05/2011	SW6020	TOTAL	Zinc	ND	U	UG/L	0.50	20.0
K RANGE	MW-474S	MW-474S_OCT11UA	86.44	96.44	10/05/2011	SW8330	METHOD	Nitroglycerin	ND	U	UG/L	0.57	1.9

Notes:

[1] Qualifiers: U = Non-detect. J = Value is estimated less than the reporting limit.

[2] MDL = Method Detection Limit

[3] RL = Reporting Limit

Table 7
T Range Validated Soil Data

Site ID	Location ID	Field Sample ID	Northing	Easting	Date Sampled	Test Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]	Sample Type
T RANGE	SSTRNGA1A	SSTRNG1A_OCT11A	4621047.58	373702.38	10/20/2011	SW6020	Antimony	0.39	J	MG/KG	0.0052	1.3	N1
T RANGE	SSTRNGA1A	SSTRNG1A_OCT11A	4621047.58	373702.38	10/20/2011	SW6020	Lead	23.9		MG/KG	0.31	12.7	N1
T RANGE	SSTRNGA1A	SSTRNG1A_OCT11A	4621047.58	373702.38	10/20/2011	SW6020	Copper	30.2		MG/KG	0.020	2.5	N1
T RANGE	SSTRNGA1A	SSTRNG1A_OCT11A	4621047.58	373702.38	10/20/2011	SW6020	Zinc	33.0		MG/KG	0.14	2.5	N1
T RANGE	SSTRNGA1A	SSTRNG1A_OCT11A	4621047.58	373702.38	10/20/2011	SW6020	Tungsten	ND	U	MG/KG	0.016	0.17	N1
T RANGE	SSTRNGA1A	SSTRNG1A_OCT11A	4621047.58	373702.38	10/20/2011	SW8330	Nitroglycerin	15700		UG/KG	591	1930	N1
T RANGE	SSTRNGA1A	SSTRNG1A_OCT11B	4621047.58	373702.38	10/20/2011	SW6020	Antimony	0.45	J	MG/KG	0.0064	1.6	FR1
T RANGE	SSTRNGA1A	SSTRNG1A_OCT11B	4621047.58	373702.38	10/20/2011	SW6020	Lead	23.4		MG/KG	0.038	1.6	FR1
T RANGE	SSTRNGA1A	SSTRNG1A_OCT11B	4621047.58	373702.38	10/20/2011	SW6020	Zinc	45.8		MG/KG	0.17	3.1	FR1
T RANGE	SSTRNGA1A	SSTRNG1A_OCT11B	4621047.58	373702.38	10/20/2011	SW6020	Copper	92.5		MG/KG	0.025	3.1	FR1
T RANGE	SSTRNGA1A	SSTRNG1A_OCT11B	4621047.58	373702.38	10/20/2011	SW6020	Tungsten	ND	U	MG/KG	0.020	0.16	FR1
T RANGE	SSTRNGA1A	SSTRNG1A_OCT11B	4621047.58	373702.38	10/20/2011	SW8330	Nitroglycerin	23200		UG/KG	571	1870	FR1
T RANGE	SSTRNGA1A	SSTRNG1A_OCT11C	4621047.58	373702.38	10/20/2011	SW6020	Antimony	0.35	J	MG/KG	0.0051	1.3	FR1
T RANGE	SSTRNGA1A	SSTRNG1A_OCT11C	4621047.58	373702.38	10/20/2011	SW6020	Lead	22.1		MG/KG	0.030	1.3	FR1
T RANGE	SSTRNGA1A	SSTRNG1A_OCT11C	4621047.58	373702.38	10/20/2011	SW6020	Copper	25.6		MG/KG	0.020	2.5	FR1
T RANGE	SSTRNGA1A	SSTRNG1A_OCT11C	4621047.58	373702.38	10/20/2011	SW6020	Zinc	30.9		MG/KG	0.14	2.5	FR1
T RANGE	SSTRNGA1A	SSTRNG1A_OCT11C	4621047.58	373702.38	10/20/2011	SW6020	Tungsten	ND	U	MG/KG	0.016	0.13	FR1
T RANGE	SSTRNGA1A	SSTRNG1A_OCT11C	4621047.58	373702.38	10/20/2011	SW8330	Nitroglycerin	18000		UG/KG	571	1870	FR1
T RANGE	SSTRNGA1B	SSTRNG1B_OCT11A	4621044.14	373699.09	10/20/2011	SW6020	Copper	14.8		MG/KG	0.023	2.9	N1
T RANGE	SSTRNGA1B	SSTRNG1B_OCT11A	4621044.14	373699.09	10/20/2011	SW6020	Lead	20.1		MG/KG	0.035	1.4	N1
T RANGE	SSTRNGA1B	SSTRNG1B_OCT11A	4621044.14	373699.09	10/20/2011	SW6020	Zinc	26.0		MG/KG	0.16	2.9	N1
T RANGE	SSTRNGA1B	SSTRNG1B_OCT11A	4621044.14	373699.09	10/20/2011	SW6020	Antimony	ND	U	MG/KG	0.0059	1.4	N1
T RANGE	SSTRNGA1B	SSTRNG1B_OCT11A	4621044.14	373699.09	10/20/2011	SW6020	Tungsten	ND	U	MG/KG	0.018	0.21	N1
T RANGE	SSTRNGA1B	SSTRNG1B_OCT11A	4621044.14	373699.09	10/20/2011	SW8330	Nitroglycerin	3660	J	UG/KG	606	1980	N1
T RANGE	SSTRNGA1B	SSTRNG1B_OCT11B	4621044.14	373699.09	10/20/2011	SW6020	Copper	12.3		MG/KG	0.017	2.1	FR1
T RANGE	SSTRNGA1B	SSTRNG1B_OCT11B	4621044.14	373699.09	10/20/2011	SW6020	Lead	20.8		MG/KG	0.025	1.0	FR1
T RANGE	SSTRNGA1B	SSTRNG1B_OCT11B	4621044.14	373699.09	10/20/2011	SW6020	Zinc	25.4		MG/KG	0.11	2.1	FR1
T RANGE	SSTRNGA1B	SSTRNG1B_OCT11B	4621044.14	373699.09	10/20/2011	SW6020	Antimony	ND	U	MG/KG	0.0043	1.0	FR1
T RANGE	SSTRNGA1B	SSTRNG1B_OCT11B	4621044.14	373699.09	10/20/2011	SW6020	Tungsten	ND	U	MG/KG	0.013	0.19	FR1
T RANGE	SSTRNGA1B	SSTRNG1B_OCT11B	4621044.14	373699.09	10/20/2011	SW8330	Nitroglycerin	3660	J	UG/KG	598	1960	FR1
T RANGE	SSTRNGA1B	SSTRNG1B_OCT11C	4621044.14	373699.09	10/20/2011	SW6020	Zinc	12.4		MG/KG	0.081	1.5	FR1
T RANGE	SSTRNGA1B	SSTRNG1B_OCT11C	4621044.14	373699.09	10/20/2011	SW6020	Lead	25.6		MG/KG	0.035	1.5	FR1
T RANGE	SSTRNGA1B	SSTRNG1B_OCT11C	4621044.14	373699.09	10/20/2011	SW6020	Copper	6.6		MG/KG	0.012	1.5	FR1
T RANGE	SSTRNGA1B	SSTRNG1B_OCT11C	4621044.14	373699.09	10/20/2011	SW6020	Antimony	ND	U	MG/KG	0.0060	1.5	FR1
T RANGE	SSTRNGA1B	SSTRNG1B_OCT11C	4621044.14	373699.09	10/20/2011	SW6020	Tungsten	ND	U	MG/KG	0.018	0.15	FR1
T RANGE	SSTRNGA1B	SSTRNG1B_OCT11C	4621044.14	373699.09	10/20/2011	SW8330	Nitroglycerin	4700	J	UG/KG	583	1900	FR1
T RANGE	SSTRNGA1C	SSTRNG1C_OCT11A	4621040.45	373695.76	10/20/2011	SW6020	Antimony	0.95	J	MG/KG	0.0043	1.1	N1
T RANGE	SSTRNGA1C	SSTRNG1C_OCT11A	4621040.45	373695.76	10/20/2011	SW6020	Tungsten	1.5		MG/KG	0.013	0.11	N1
T RANGE	SSTRNGA1C	SSTRNG1C_OCT11A	4621040.45	373695.76	10/20/2011	SW6020	Copper	228		MG/KG	0.84	105	N1
T RANGE	SSTRNGA1C	SSTRNG1C_OCT11A	4621040.45	373695.76	10/20/2011	SW6020	Lead	418		MG/KG	0.25	10.5	N1
T RANGE	SSTRNGA1C	SSTRNG1C_OCT11A	4621040.45	373695.76	10/20/2011	SW6020	Zinc	54.7	J	MG/KG	5.8	105	N1
T RANGE	SSTRNGA1C	SSTRNG1C_OCT11A	4621040.45	373695.76	10/20/2011	SW8330	Nitroglycerin	7120	J	UG/KG	595	1950	N1

Table 7
T Range Validated Soil Data

Site ID	Location ID	Field Sample ID	Northing	Easting	Date Sampled	Test Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]	Sample Type
T RANGE	SSTRNGA1C	SSTRNG1C_OCT11B	4621040.45	373695.76	10/20/2011	SW6020	Tungsten	1.2		MG/KG	0.014	0.11	FR1
T RANGE	SSTRNGA1C	SSTRNG1C_OCT11B	4621040.45	373695.76	10/20/2011	SW6020	Antimony	1.3		MG/KG	0.0045	1.1	FR1
T RANGE	SSTRNGA1C	SSTRNG1C_OCT11B	4621040.45	373695.76	10/20/2011	SW6020	Copper	116		MG/KG	0.88	110	FR1
T RANGE	SSTRNGA1C	SSTRNG1C_OCT11B	4621040.45	373695.76	10/20/2011	SW6020	Zinc	37.8		MG/KG	0.12	2.2	FR1
T RANGE	SSTRNGA1C	SSTRNG1C_OCT11B	4621040.45	373695.76	10/20/2011	SW6020	Lead	387		MG/KG	0.26	11.0	FR1
T RANGE	SSTRNGA1C	SSTRNG1C_OCT11B	4621040.45	373695.76	10/20/2011	SW8330	Nitroglycerin	6100	J	UG/KG	599	1960	FR1
T RANGE	SSTRNGA1C	SSTRNG1C_OCT11C	4621040.45	373695.76	10/20/2011	SW6020	Antimony	1.2	J	MG/KG	0.0053	1.3	FR1
T RANGE	SSTRNGA1C	SSTRNG1C_OCT11C	4621040.45	373695.76	10/20/2011	SW6020	Tungsten	1.4		MG/KG	0.016	0.13	FR1
T RANGE	SSTRNGA1C	SSTRNG1C_OCT11C	4621040.45	373695.76	10/20/2011	SW6020	Copper	222		MG/KG	1.0	130	FR1
T RANGE	SSTRNGA1C	SSTRNG1C_OCT11C	4621040.45	373695.76	10/20/2011	SW6020	Lead	439		MG/KG	0.31	13.0	FR1
T RANGE	SSTRNGA1C	SSTRNG1C_OCT11C	4621040.45	373695.76	10/20/2011	SW6020	Zinc	44.1		MG/KG	0.14	2.6	FR1
T RANGE	SSTRNGA1C	SSTRNG1C_OCT11C	4621040.45	373695.76	10/20/2011	SW8330	Nitroglycerin	6230	J	UG/KG	611	2000	FR1
T RANGE	SSTRNGA1D	SSTRNG1D_OCT11A	4621036.81	373692.3	10/21/2011	SW6020	Antimony	0.82	J	MG/KG	0.0047	1.1	N1
T RANGE	SSTRNGA1D	SSTRNG1D_OCT11A	4621036.81	373692.3	10/21/2011	SW6020	Copper	189		MG/KG	0.091	11.4	N1
T RANGE	SSTRNGA1D	SSTRNG1D_OCT11A	4621036.81	373692.3	10/21/2011	SW6020	Zinc	22.7		MG/KG	0.063	1.1	N1
T RANGE	SSTRNGA1D	SSTRNG1D_OCT11A	4621036.81	373692.3	10/21/2011	SW6020	Lead	257		MG/KG	0.27	11.4	N1
T RANGE	SSTRNGA1D	SSTRNG1D_OCT11A	4621036.81	373692.3	10/21/2011	SW6020	Tungsten	8.3		MG/KG	0.014	0.11	N1
T RANGE	SSTRNGA1D	SSTRNG1D_OCT11A	4621036.81	373692.3	10/21/2011	SW8330	Nitroglycerin	11200		UG/KG	577	1890	N1
T RANGE	SSTRNGA1D	SSTRNG1D_OCT11B	4621036.81	373692.3	10/21/2011	SW6020	Antimony	1.3		MG/KG	0.0051	1.2	FR1
T RANGE	SSTRNGA1D	SSTRNG1D_OCT11B	4621036.81	373692.3	10/21/2011	SW6020	Tungsten	11.9		MG/KG	0.016	0.12	FR1
T RANGE	SSTRNGA1D	SSTRNG1D_OCT11B	4621036.81	373692.3	10/21/2011	SW6020	Copper	274		MG/KG	0.099	12.4	FR1
T RANGE	SSTRNGA1D	SSTRNG1D_OCT11B	4621036.81	373692.3	10/21/2011	SW6020	Zinc	30.0		MG/KG	0.068	1.2	FR1
T RANGE	SSTRNGA1D	SSTRNG1D_OCT11B	4621036.81	373692.3	10/21/2011	SW6020	Lead	314		MG/KG	0.30	12.4	FR1
T RANGE	SSTRNGA1D	SSTRNG1D_OCT11B	4621036.81	373692.3	10/21/2011	SW8330	Nitroglycerin	16600		UG/KG	570	1860	FR1
T RANGE	SSTRNGA1D	SSTRNG1D_OCT11C	4621036.81	373692.3	10/21/2011	SW6020	Antimony	1.4	J	MG/KG	0.0061	1.5	FR1
T RANGE	SSTRNGA1D	SSTRNG1D_OCT11C	4621036.81	373692.3	10/21/2011	SW6020	Copper	268		MG/KG	0.12	14.8	FR1
T RANGE	SSTRNGA1D	SSTRNG1D_OCT11C	4621036.81	373692.3	10/21/2011	SW6020	Zinc	31.8		MG/KG	0.081	1.5	FR1
T RANGE	SSTRNGA1D	SSTRNG1D_OCT11C	4621036.81	373692.3	10/21/2011	SW6020	Lead	385		MG/KG	0.36	14.8	FR1
T RANGE	SSTRNGA1D	SSTRNG1D_OCT11C	4621036.81	373692.3	10/21/2011	SW6020	Tungsten	8.1		MG/KG	0.019	0.15	FR1
T RANGE	SSTRNGA1D	SSTRNG1D_OCT11C	4621036.81	373692.3	10/21/2011	SW8330	Nitroglycerin	12200		UG/KG	618	2020	FR1
T RANGE	SSTRNGA1E	SSTRNG1E_OCT11A	4621032.9	373689.03	10/21/2011	SW6020	Antimony	1.4		MG/KG	0.0049	1.2	N1
T RANGE	SSTRNGA1E	SSTRNG1E_OCT11A	4621032.9	373689.03	10/21/2011	SW6020	Zinc	27.8		MG/KG	0.066	1.2	N1
T RANGE	SSTRNGA1E	SSTRNG1E_OCT11A	4621032.9	373689.03	10/21/2011	SW6020	Lead	378		MG/KG	0.29	12.0	N1
T RANGE	SSTRNGA1E	SSTRNG1E_OCT11A	4621032.9	373689.03	10/21/2011	SW6020	Copper	71.8		MG/KG	0.019	2.4	N1
T RANGE	SSTRNGA1E	SSTRNG1E_OCT11A	4621032.9	373689.03	10/21/2011	SW6020	Tungsten	ND	U	MG/KG	0.015	1.2	N1
T RANGE	SSTRNGA1E	SSTRNG1E_OCT11A	4621032.9	373689.03	10/21/2011	SW8330	Nitroglycerin	21800		UG/KG	588	1920	N1
T RANGE	SSTRNGA1E	SSTRNG1E_OCT11B	4621032.9	373689.03	10/21/2011	SW6020	Antimony	1.3	J	MG/KG	0.0063	1.5	FR1
T RANGE	SSTRNGA1E	SSTRNG1E_OCT11B	4621032.9	373689.03	10/21/2011	SW6020	Zinc	26.1		MG/KG	0.17	3.1	FR1
T RANGE	SSTRNGA1E	SSTRNG1E_OCT11B	4621032.9	373689.03	10/21/2011	SW6020	Lead	319		MG/KG	0.37	15.4	FR1
T RANGE	SSTRNGA1E	SSTRNG1E_OCT11B	4621032.9	373689.03	10/21/2011	SW6020	Copper	65.6		MG/KG	0.025	3.1	FR1
T RANGE	SSTRNGA1E	SSTRNG1E_OCT11B	4621032.9	373689.03	10/21/2011	SW6020	Tungsten	ND	U	MG/KG	0.019	1.3	FR1
T RANGE	SSTRNGA1E	SSTRNG1E_OCT11B	4621032.9	373689.03	10/21/2011	SW8330	Nitroglycerin	19600		UG/KG	571	1870	FR1

Table 7
T Range Validated Soil Data

Site ID	Location ID	Field Sample ID	Northing	Easting	Date Sampled	Test Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]	Sample Type
T RANGE	SSTRNGA1E	SSTRNG1E_OCT11C	4621032.9	373689.03	10/21/2011	SW6020	Antimony	1.1	J	MG/KG	0.0062	1.5	FR1
T RANGE	SSTRNGA1E	SSTRNG1E_OCT11C	4621032.9	373689.03	10/21/2011	SW6020	Zinc	21.6		MG/KG	0.083	1.5	FR1
T RANGE	SSTRNGA1E	SSTRNG1E_OCT11C	4621032.9	373689.03	10/21/2011	SW6020	Lead	260		MG/KG	0.36	15.2	FR1
T RANGE	SSTRNGA1E	SSTRNG1E_OCT11C	4621032.9	373689.03	10/21/2011	SW6020	Copper	36.4		MG/KG	0.012	1.5	FR1
T RANGE	SSTRNGA1E	SSTRNG1E_OCT11C	4621032.9	373689.03	10/21/2011	SW6020	Tungsten	ND	U	MG/KG	0.019	1.1	FR1
T RANGE	SSTRNGA1E	SSTRNG1E_OCT11C	4621032.9	373689.03	10/21/2011	SW8330	Nitroglycerin	20800		UG/KG	611	2000	FR1
T RANGE	SSTRNGA2A	SSTRNG2A_OCT11A	4621029.53	373685.65	10/21/2011	SW6020	Lead	20.3		MG/KG	0.029	1.2	N1
T RANGE	SSTRNGA2A	SSTRNG2A_OCT11A	4621029.53	373685.65	10/21/2011	SW6020	Zinc	37.6		MG/KG	0.13	2.4	N1
T RANGE	SSTRNGA2A	SSTRNG2A_OCT11A	4621029.53	373685.65	10/21/2011	SW6020	Antimony	ND	U	MG/KG	0.0049	1.2	N1
T RANGE	SSTRNGA2A	SSTRNG2A_OCT11A	4621029.53	373685.65	10/21/2011	SW6020	Copper	ND	U	MG/KG	0.0096	13.1	N1
T RANGE	SSTRNGA2A	SSTRNG2A_OCT11A	4621029.53	373685.65	10/21/2011	SW6020	Tungsten	ND	U	MG/KG	0.015	0.12	N1

Notes:

[1] Qualifiers: U = Non-detect. J = Value is estimated less than the reporting limit or due to limitation identified in the data validation.

[2] MDL = Method Detection Limit

[3] RL = Reporting Limit

Table 8

T Range Validated Lysimeter Data

Site ID	Location ID	Field Sample ID	Northing	Easting	Date Sampled	Test Method	Extraction Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]
T RANGE	LYTRNG011	LYTR011_OCT11FA	4621043.62	373700.93	10/11/2011	SW6020	FLDFLT	Zinc	0.51	J	UG/L	0.50	20.0
T RANGE	LYTRNG011	LYTR011_OCT11FA	4621043.62	373700.93	10/11/2011	SW6020	FLDFLT	Copper	1.9	J	UG/L	0.23	20.0
T RANGE	LYTRNG011	LYTR011_OCT11FA	4621043.62	373700.93	10/11/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	0.073	20.0
T RANGE	LYTRNG011	LYTR011_OCT11FA	4621043.62	373700.93	10/11/2011	SW6020	FLDFLT	Lead	ND	U	UG/L	0.024	2.0
T RANGE	LYTRNG011	LYTR011_OCT11UA	4621043.62	373700.93	10/11/2011	SW6020	TOTAL	Copper	0.98	J	UG/L	0.23	20.0
T RANGE	LYTRNG011	LYTR011_OCT11UA	4621043.62	373700.93	10/11/2011	SW6020	TOTAL	Zinc	1.7	J	UG/L	0.50	20.0
T RANGE	LYTRNG011	LYTR011_OCT11UA	4621043.62	373700.93	10/11/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	0.073	20.0
T RANGE	LYTRNG011	LYTR011_OCT11UA	4621043.62	373700.93	10/11/2011	SW6020	TOTAL	Lead	ND	U	UG/L	0.024	2.0
T RANGE	LYTRNG011	LYTR011_OCT11UA	4621043.62	373700.93	10/11/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.16	2.0
T RANGE	LYTRNG011	LYTR011_OCT11UA	4621043.62	373700.93	10/11/2011	SW8330	METHOD	Nitroglycerin	ND	U	UG/L	0.57	1.9
T RANGE	LYTRNG012	LYTR012_OCT11FA	4621035.71	373692.76	10/11/2011	SW6020	FLDFLT	Copper	4.9	J	UG/L	0.23	20.0
T RANGE	LYTRNG012	LYTR012_OCT11FA	4621035.71	373692.76	10/11/2011	SW6020	FLDFLT	Zinc	6.4	J	UG/L	0.50	20.0
T RANGE	LYTRNG012	LYTR012_OCT11FA	4621035.71	373692.76	10/11/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	0.073	20.0
T RANGE	LYTRNG012	LYTR012_OCT11FA	4621035.71	373692.76	10/11/2011	SW6020	FLDFLT	Lead	ND	U	UG/L	0.024	2.0
T RANGE	LYTRNG012	LYTR012_OCT11UA	4621035.71	373692.76	10/11/2011	SW6020	TOTAL	Copper	0.72	J	UG/L	0.23	20.0
T RANGE	LYTRNG012	LYTR012_OCT11UA	4621035.71	373692.76	10/11/2011	SW6020	TOTAL	Zinc	3.7	J	UG/L	0.50	20.0
T RANGE	LYTRNG012	LYTR012_OCT11UA	4621035.71	373692.76	10/11/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	0.073	20.0
T RANGE	LYTRNG012	LYTR012_OCT11UA	4621035.71	373692.76	10/11/2011	SW6020	TOTAL	Lead	ND	U	UG/L	0.024	2.0
T RANGE	LYTRNG012	LYTR012_OCT11UA	4621035.71	373692.76	10/11/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.16	2.0
T RANGE	LYTRNG012	LYTR012_OCT11UA	4621035.71	373692.76	10/11/2011	SW8330	METHOD	Nitroglycerin	ND	UJ	UG/L	0.57	3.0
T RANGE	LYTRNG013	LYTR013_OCT11FA	4621028.28	373684.12	10/11/2011	SW6020	FLDFLT	Zinc	12.2	J	UG/L	0.50	20.0
T RANGE	LYTRNG013	LYTR013_OCT11FA	4621028.28	373684.12	10/11/2011	SW6020	FLDFLT	Copper	3.2	J	UG/L	0.23	20.0
T RANGE	LYTRNG013	LYTR013_OCT11FA	4621028.28	373684.12	10/11/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	0.073	20.0
T RANGE	LYTRNG013	LYTR013_OCT11FA	4621028.28	373684.12	10/11/2011	SW6020	FLDFLT	Lead	ND	U	UG/L	0.024	2.0
T RANGE	LYTRNG013	LYTR013_OCT11UA	4621028.28	373684.12	10/11/2011	SW6020	TOTAL	Copper	1.7	J	UG/L	0.23	20.0
T RANGE	LYTRNG013	LYTR013_OCT11UA	4621028.28	373684.12	10/11/2011	SW6020	TOTAL	Zinc	7.5	J	UG/L	0.50	20.0
T RANGE	LYTRNG013	LYTR013_OCT11UA	4621028.28	373684.12	10/11/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	0.073	20.0
T RANGE	LYTRNG013	LYTR013_OCT11UA	4621028.28	373684.12	10/11/2011	SW6020	TOTAL	Lead	ND	U	UG/L	0.024	2.0
T RANGE	LYTRNG013	LYTR013_OCT11UA	4621028.28	373684.12	10/11/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.16	2.0
T RANGE	LYTRNG013	LYTR013_OCT11UA	4621028.28	373684.12	10/11/2011	SW8330	METHOD	Nitroglycerin	ND	U	UG/L	0.58	1.9

Notes:

[1] Qualifiers: U = Non-detect. J = Value is estimated less than the reporting limit. UJ = The analyte was not detected above this value and is estimated due matrix interferences.

[2] MDL = Method Detection Limit

[3] RL = Reporting Limit

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Table 9
T Range Validated Groundwater Data

Site ID	Location ID	Field Sample ID	Top depth (ft bgs)	Bottom Depth (ft bgs)	Date Sampled	Test Method	Extraction Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]
T RANGE	MW-467S	MW-467S_OCT11FA	124.94	134.94	10/10/2011	SW6020	FLDFLT	Zinc	18.2	J	UG/L	0.50	20.0
T RANGE	MW-467S	MW-467S_OCT11FA	124.94	134.94	10/10/2011	SW6020	FLDFLT	Copper	2.2	J	UG/L	0.23	20.0
T RANGE	MW-467S	MW-467S_OCT11FA	124.94	134.94	10/10/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	0.073	20.0
T RANGE	MW-467S	MW-467S_OCT11FA	124.94	134.94	10/10/2011	SW6020	FLDFLT	Lead	ND	U	UG/L	0.024	2.0
T RANGE	MW-467S	MW-467S_OCT11UA	124.94	134.94	10/10/2011	SW6020	TOTAL	Zinc	1.7	J	UG/L	0.50	20.0
T RANGE	MW-467S	MW-467S_OCT11UA	124.94	134.94	10/10/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	0.073	20.0
T RANGE	MW-467S	MW-467S_OCT11UA	124.94	134.94	10/10/2011	SW6020	TOTAL	Copper	ND	U	UG/L	0.23	20.0
T RANGE	MW-467S	MW-467S_OCT11UA	124.94	134.94	10/10/2011	SW6020	TOTAL	Lead	ND	U	UG/L	0.024	2.0
T RANGE	MW-467S	MW-467S_OCT11UA	124.94	134.94	10/10/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.16	2.0
T RANGE	MW-467S	MW-467S_OCT11UA	124.94	134.94	10/10/2011	SW8330	METHOD	Nitroglycerin	ND	U	UG/L	0.57	1.9
T RANGE	MW-489S	MW-489S_OCT11FA	124.58	134.58	10/11/2011	SW6020	FLDFLT	Copper	0.88	J	UG/L	0.23	20.0
T RANGE	MW-489S	MW-489S_OCT11FA	124.58	134.58	10/11/2011	SW6020	FLDFLT	Antimony	ND	U	UG/L	0.073	20.0
T RANGE	MW-489S	MW-489S_OCT11FA	124.58	134.58	10/11/2011	SW6020	FLDFLT	Lead	ND	U	UG/L	0.024	2.0
T RANGE	MW-489S	MW-489S_OCT11FA	124.58	134.58	10/11/2011	SW6020	FLDFLT	Zinc	ND	U	UG/L	0.50	20.0
T RANGE	MW-489S	MW-489S_OCT11UA	124.58	134.58	10/11/2011	SW6020	TOTAL	Copper	0.30	J	UG/L	0.23	20.0
T RANGE	MW-489S	MW-489S_OCT11UA	124.58	134.58	10/11/2011	SW6020	TOTAL	Antimony	ND	U	UG/L	0.073	20.0
T RANGE	MW-489S	MW-489S_OCT11UA	124.58	134.58	10/11/2011	SW6020	TOTAL	Lead	ND	U	UG/L	0.024	2.0
T RANGE	MW-489S	MW-489S_OCT11UA	124.58	134.58	10/11/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.16	2.0
T RANGE	MW-489S	MW-489S_OCT11UA	124.58	134.58	10/11/2011	SW6020	TOTAL	Zinc	ND	U	UG/L	0.50	20.0
T RANGE	MW-489S	MW-489S_OCT11UA	124.58	134.58	10/11/2011	SW8330	METHOD	Nitroglycerin	ND	U	UG/L	0.57	1.9

Notes:

[1] Qualifiers: U = Non-detect. J = Value is estimated less than the reporting limit.

[2] MDL = Method Detection Limit

[3] RL = Reporting Limit

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Table 10
J, K and T Ranges Validated STAPP Data

Site ID	Location ID	Field Sample ID	Date Sampled	Test Method	Extraction Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]
J RANGE	WLJRNG	WLJRSTAPP_OCT11	10/13/2011	SW6010B	TOTAL	Copper	17.2	J	UG/L	1.6	25.0
J RANGE	WLJRNG	WLJRSTAPP_OCT11	10/13/2011	SW6010B	TOTAL	Magnesium	18800		UG/L	64.0	5000
J RANGE	WLJRNG	WLJRSTAPP_OCT11	10/13/2011	SW6010B	TOTAL	Potassium	2260	J	UG/L	180	5000
J RANGE	WLJRNG	WLJRSTAPP_OCT11	10/13/2011	SW6010B	TOTAL	Barium	25.6	J	UG/L	5.2	200
J RANGE	WLJRNG	WLJRSTAPP_OCT11	10/13/2011	SW6010B	TOTAL	Chromium, Total	3.1	J	UG/L	0.55	10.0
J RANGE	WLJRNG	WLJRSTAPP_OCT11	10/13/2011	SW6010B	TOTAL	Nickel	3.7	J	UG/L	1.8	40.0
J RANGE	WLJRNG	WLJRSTAPP_OCT11	10/13/2011	SW6010B	TOTAL	Zinc	30200		UG/L	0.75	20.0
J RANGE	WLJRNG	WLJRSTAPP_OCT11	10/13/2011	SW6010B	TOTAL	Calcium	33800		UG/L	120	5000
J RANGE	WLJRNG	WLJRSTAPP_OCT11	10/13/2011	SW6010B	TOTAL	Lead	39.2		UG/L	5.4	10.0
J RANGE	WLJRNG	WLJRSTAPP_OCT11	10/13/2011	SW6010B	TOTAL	Aluminum	3990		UG/L	39.0	200
J RANGE	WLJRNG	WLJRSTAPP_OCT11	10/13/2011	SW6010B	TOTAL	Iron	3990		UG/L	39.0	200
J RANGE	WLJRNG	WLJRSTAPP_OCT11	10/13/2011	SW6010B	TOTAL	Sodium	4610	J	UG/L	51.0	5000
J RANGE	WLJRNG	WLJRSTAPP_OCT11	10/13/2011	SW6010B	TOTAL	Vanadium	6.4	J	UG/L	1.6	50.0
J RANGE	WLJRNG	WLJRSTAPP_OCT11	10/13/2011	SW6010B	TOTAL	Manganese	68.6		UG/L	1.9	15.0
J RANGE	WLJRNG	WLJRSTAPP_OCT11	10/13/2011	SW6010B	TOTAL	Boron	71.9	J	UG/L	1.7	100
J RANGE	WLJRNG	WLJRSTAPP_OCT11	10/13/2011	SW6010B	TOTAL	Cobalt	ND	U	UG/L	0.92	50.0
J RANGE	WLJRNG	WLJRSTAPP_OCT11	10/13/2011	SW6010B	TOTAL	Molybdenum	ND	U	UG/L	1.5	10.0
J RANGE	WLJRNG	WLJRSTAPP_OCT11	10/13/2011	SW6010B	TOTAL	Selenium	ND	U	UG/L	6.1	35.0
J RANGE	WLJRNG	WLJRSTAPP_OCT11	10/13/2011	SW6010B	TOTAL	Silver	ND	U	UG/L	2.1	10.0
J RANGE	WLJRNG	WLJRSTAPP_OCT11	10/13/2011	SW6020	TOTAL	Cadmium	0.69	J	UG/L	0.046	2.0
J RANGE	WLJRNG	WLJRSTAPP_OCT11	10/13/2011	SW6020	TOTAL	Antimony	54.0		UG/L	0.073	20.0
J RANGE	WLJRNG	WLJRSTAPP_OCT11	10/13/2011	SW6020	TOTAL	Arsenic	ND	U	UG/L	0.18	4.0
J RANGE	WLJRNG	WLJRSTAPP_OCT11	10/13/2011	SW6020	TOTAL	Beryllium	ND	U	UG/L	0.092	2.0
J RANGE	WLJRNG	WLJRSTAPP_OCT11	10/13/2011	SW6020	TOTAL	Thallium	ND	U	UG/L	0.079	2.0
J RANGE	WLJRNG	WLJRSTAPP_OCT11	10/13/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.16	2.0
J RANGE	WLJRNG	WLJRSTAPP_OCT11	10/13/2011	SW7470A	TOTAL	Mercury	ND	U	UG/L	0.066	0.20
K RANGE	WLKRNG	WLKRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Copper	101		UG/L	1.6	25.0
K RANGE	WLKRNG	WLKRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Nickel	17.2	J	UG/L	1.8	40.0
K RANGE	WLKRNG	WLKRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Cobalt	2.3	J	UG/L	0.92	50.0
K RANGE	WLKRNG	WLKRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Zinc	20300		UG/L	0.75	20.0
K RANGE	WLKRNG	WLKRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Potassium	2040	J	UG/L	180	5000
K RANGE	WLKRNG	WLKRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Barium	21.1	J	UG/L	5.2	200
K RANGE	WLKRNG	WLKRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Boron	218		UG/L	1.7	100
K RANGE	WLKRNG	WLKRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Magnesium	23200		UG/L	64.0	5000
K RANGE	WLKRNG	WLKRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Manganese	33.2		UG/L	1.9	15.0
K RANGE	WLKRNG	WLKRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Sodium	5920		UG/L	51.0	5000
K RANGE	WLKRNG	WLKRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Lead	62.1		UG/L	5.4	10.0
K RANGE	WLKRNG	WLKRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Calcium	78300		UG/L	120	5000
K RANGE	WLKRNG	WLKRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Aluminum	ND	U	UG/L	39.0	200
K RANGE	WLKRNG	WLKRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Chromium, Total	ND	U	UG/L	0.55	10.0
K RANGE	WLKRNG	WLKRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Iron	ND	U	UG/L	39.0	200
K RANGE	WLKRNG	WLKRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Molybdenum	ND	U	UG/L	1.5	10.0
K RANGE	WLKRNG	WLKRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Selenium	ND	U	UG/L	6.1	35.0

Table 10
J, K and T Ranges Validated STAPP Data

Site ID	Location ID	Field Sample ID	Date Sampled	Test Method	Extraction Method	Analyte	Result Value	Qualifier[1]	Units	MDL[2]	RL[3]
K RANGE	WLKRNG	WLKRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Silver	ND	U	UG/L	2.1	10.0
K RANGE	WLKRNG	WLKRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Vanadium	ND	U	UG/L	1.6	50.0
K RANGE	WLKRNG	WLKRSTAPP_OCT11	10/12/2011	SW6020	TOTAL	Cadmium	2.8		UG/L	0.046	2.0
K RANGE	WLKRNG	WLKRSTAPP_OCT11	10/12/2011	SW6020	TOTAL	Antimony	250		UG/L	0.073	20.0
K RANGE	WLKRNG	WLKRSTAPP_OCT11	10/12/2011	SW6020	TOTAL	Arsenic	ND	U	UG/L	0.092	2.5
K RANGE	WLKRNG	WLKRSTAPP_OCT11	10/12/2011	SW6020	TOTAL	Beryllium	ND	U	UG/L	0.18	4.0
K RANGE	WLKRNG	WLKRSTAPP_OCT11	10/12/2011	SW6020	TOTAL	Thallium	ND	U	UG/L	0.079	2.0
K RANGE	WLKRNG	WLKRSTAPP_OCT11	10/12/2011	SW6020	TOTAL	Tungsten	ND	U	UG/L	0.16	2.0
K RANGE	WLKRNG	WLKRSTAPP_OCT11	10/12/2011	SW7470A	TOTAL	Mercury	ND	U	UG/L	0.066	0.20
T RANGE	WLTRNG	WLTRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Chromium, Total	0.70	J	UG/L	0.55	10.0
T RANGE	WLTRNG	WLTRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Vanadium	1.7	J	UG/L	1.6	50.0
T RANGE	WLTRNG	WLTRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Manganese	118		UG/L	1.9	15.0
T RANGE	WLTRNG	WLTRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Iron	121	J	UG/L	39.0	200
T RANGE	WLTRNG	WLTRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Calcium	157000		UG/L	120	5000
T RANGE	WLTRNG	WLTRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Magnesium	27900		UG/L	64.0	5000
T RANGE	WLTRNG	WLTRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Barium	33.1	J	UG/L	5.2	200
T RANGE	WLTRNG	WLTRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Zinc	49900		UG/L	0.75	20.0
T RANGE	WLTRNG	WLTRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Copper	5.3	J	UG/L	1.6	25.0
T RANGE	WLTRNG	WLTRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Boron	72.0	J	UG/L	1.7	100
T RANGE	WLTRNG	WLTRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Sodium	72900		UG/L	51.0	5000
T RANGE	WLTRNG	WLTRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Potassium	7410		UG/L	180	5000
T RANGE	WLTRNG	WLTRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Lead	87.2		UG/L	5.4	10.0
T RANGE	WLTRNG	WLTRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Aluminum	ND	U	UG/L	39.0	200
T RANGE	WLTRNG	WLTRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Cobalt	ND	U	UG/L	0.92	50.0
T RANGE	WLTRNG	WLTRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Molybdenum	ND	U	UG/L	1.5	10.0
T RANGE	WLTRNG	WLTRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Nickel	ND	U	UG/L	1.8	40.0
T RANGE	WLTRNG	WLTRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Selenium	ND	U	UG/L	6.1	35.0
T RANGE	WLTRNG	WLTRSTAPP_OCT11	10/12/2011	SW6010B	TOTAL	Silver	ND	U	UG/L	2.1	10.0
T RANGE	WLTRNG	WLTRSTAPP_OCT11	10/12/2011	SW6020	TOTAL	Cadmium	1.2	J	UG/L	0.046	2.0
T RANGE	WLTRNG	WLTRSTAPP_OCT11	10/12/2011	SW6020	TOTAL	Antimony	141		UG/L	0.073	20.0
T RANGE	WLTRNG	WLTRSTAPP_OCT11	10/12/2011	SW6020	TOTAL	Tungsten	4.3		UG/L	0.16	2.0
T RANGE	WLTRNG	WLTRSTAPP_OCT11	10/12/2011	SW6020	TOTAL	Arsenic	ND	U	UG/L	0.092	2.0
T RANGE	WLTRNG	WLTRSTAPP_OCT11	10/12/2011	SW6020	TOTAL	Beryllium	ND	U	UG/L	0.092	2.0
T RANGE	WLTRNG	WLTRSTAPP_OCT11	10/12/2011	SW6020	TOTAL	Thallium	ND	U	UG/L	0.079	2.0
T RANGE	WLTRNG	WLTRSTAPP_OCT11	10/12/2011	SW7470A	TOTAL	Mercury	ND	U	UG/L	0.066	0.20

Notes:
[1] Qualifiers: U = Non-detect. J = Value is estimated less than the reporting limit.
[2] MDL = Method Detection Limit
[3] RL = Reporting Limit

SIERRA AND INDIA RANGES
2012 ENVIRONMENTAL SAMPLING AND ANALYSIS REPORT

Sampling Conducted September and November 2012

1.0 INTRODUCTION

Sierra and India Ranges (S and I Ranges) at Camp Edwards are small arms ranges (SARs) currently used for marksmanship training using copper based (i.e. lead-free) ammunition under a pilot period approved by the Environmental Management Commission (EMC). The pilot period is intended to assess these ranges and determine if the ranges can be used for live firing with copper ammunition while protecting the environment. The pilot period extends until 29 June 2014. Figure 1 shows the locations of S and I Ranges within Camp Edwards.

As part of the pilot test approval, and in accordance with the conditions established by the EMC for the Massachusetts Army National Guard (MAARNG) for firing copper ammunition, these ranges are operated and maintained as outlined in range-specific Best Management Practices and Standard Operating Procedures (SOPs). The final versions of the SOPs were approved and accepted by the EMC on 29 June, 2012 for Sierra range and 28 August 2012 for India Range.

The SOPs include a program of periodic sampling of soil, pore water, and groundwater. The samples are analyzed for select metals that are commonly used in ammunition. Soil samples and pore water samples are also analyzed for pH which is an important parameter for determining the mobility of certain metals in the environment. The goal of this monitoring program is to determine when routine maintenance activities are needed to promote range sustainability and to protect the environment.

This report summarizes the sampling program that was conducted by the MAARNG in fall 2012 as prescribed in the SOPs.

2.0 RANGE USE SUMMARY

S Range has been used as a SAR since the 1980s. It was used primarily for rifle marksmanship training with pop up targets. Investigations of soil and groundwater were completed by the Impact Area Groundwater Study Program (IAGWSP) and the Final Sierra Range Soil and Groundwater Investigation Report was completed in March 2012. No threat to groundwater or the environment was found. Reconstruction of the range was completed in 2012 and two pan lysimeters were installed on the range to monitor pore water percolating through the soil. The pilot test period commenced on S Range in the summer of

1

2012 and approximately 34,000 bullets were fired on the range in 2012. This report summarizes the first round of operational samples collected under the SOP at S Range.

I Range has been used as a SAR since the 1980s. The MANG reconstructed the range and installed a new berm in the summer of 2012. Two pan lysimeters were installed on the range in 2012 to monitor pore water percolating through the soil. The pilot test period commenced on I Range in September 2012. No live fire training was conducted on I Range prior to the September 2012 sampling.

3.0 SOP MONITORING REQUIREMENTS

3.1 Surface Soil

The soil sampling at S and I Ranges includes semi-annual multi-increment sampling (MIS) from 0 to 3 inches depth at the firing lines of both ranges. The sample areas are laid out in a strip across the width of the ranges from the firing lines to 10-meters forward of the firing lines.

Soil samples were collected from S range in September 2012. I Range will be sampled in 2013. All samples were submitted to Test America Laboratory, Inc. in Burlington, Vermont for analysis. All samples were ground and processed in accordance with Method 8330B. Soil samples were analyzed by method 6010C for antimony, copper, and lead. Soil sampling locations are shown on Figure 2 and analytical results are summarized in Table 1.

In addition, the soil at three berm locations at S Range where copper bullets are likely to accumulate were sampled and the soil was screened in the field with an XRF meter. The XRF did not detect any copper concentrations above the level of detection (LOD) of the XRF meter. The results are summarized in Table 2.

3.2 Pore Water

Pore water samples were collected from pan lysimeters installed on S and I Ranges in September 2012. All pan lysimeters are installed approximately 2 feet below the ground surface. One half of the sample volume was field filtered and both unfiltered and filtered samples were submitted for analysis. All pore water samples were analyzed by method 6020A for antimony, copper, and lead. The locations of the lysimeters are shown on Figures 3 and 4. Analytical results are summarized in Table 3.

During the September 2012 sampling, pH readings were taken from the lysimeters. Measuring the pH of the pore water provides some indication of the effectiveness of the lime additions on the range floor. The pH readings ranged from 5.7 to 6.1 as summarized in the table below. Lime was spread on the range floors at S and I Ranges in early November 2012.

Range	Sample_ID	Sample_Date	Analyte	Result
I RANGE	LYIRNG001	9/11/2012	pH	DRY
I RANGE	LYIRNG002	9/11/2012	pH	6.1
S RANGE	LYSRNG001	9/13/2012	pH	6.0
S RANGE	LYSRNG002	9/13/2012	pH	5.7

The sample from LYIRNG002 contained concentrations of antimony exceeding the action level (6 ppb). In accordance with the SOPs, this lysimeter was resampled in duplicate on 1 November 2012. Results of the resampling are included in Table 4.

3.3 Groundwater

Groundwater monitoring well locations (MW-465S and MW-466S) at S Range are shown on Figure 5. Groundwater samples were collected from these wells in September 2012. Samples were analyzed by method 6020A for antimony, copper, and lead. Results are summarized in Table 5. Samples were not filtered in the field so they provide total metals concentrations.

4.0 COMPARISON TO SOP INTERIM ACTION LEVELS

The SOPs list action levels for soil, pore water, and groundwater concentrations that trigger response actions. Action levels have been assigned for antimony, copper, and lead in soil, pore water, and groundwater. The action levels are summarized on Figure 6.

4.1 Soil

No soil action levels were exceeded.

4.2 Pore Water

No pore water action levels were exceeded at S Range.

At I Range, LYIRNG001 (at the firing line) was dry at the time of sampling so no sample could be collected from that location. The sample from LYIRNG002 contained concentrations of antimony exceeding the action level. In accordance with the SOPs, this lysimeter was resampled in duplicate on 1 November 2012. Results of the resampling indicate continued exceedences of the action levels in this lysimeter. Further investigation of the cause of the elevated antimony concentrations is currently ongoing.

4.3 Groundwater

No groundwater action levels were exceeded.

5.0 FURTHER ACTION

Comparison of the detected soil and groundwater concentrations to the action levels in the SOPs indicate that no range maintenance actions are needed at this time.

Elevated detections of antimony in one of the lysimeters required resampling to determine if the original result is representative of actual site conditions. Results confirmed the presence of antimony at levels exceeding the action level. Appropriate responses to this finding will be discussed with the regulatory agencies and Camp Edwards staff to determine an appropriate course of action. Decisions and findings will be documented via a project note or similar format.

The SOPs currently specify laboratory method 6010 for aqueous metals analyses, however, the reporting levels using this method are higher than the action levels specified in the SOPs. Method 6020 uses the same basic techniques and methods but achieves lower reporting limits and minimum detection limits. The SOPs will be changed to specify that aqueous metals analyses will be conducted using method 6020.

Soil, pore water, and groundwater samples will be collected again in the fall of 2013.

FIGURES and TABLES

5

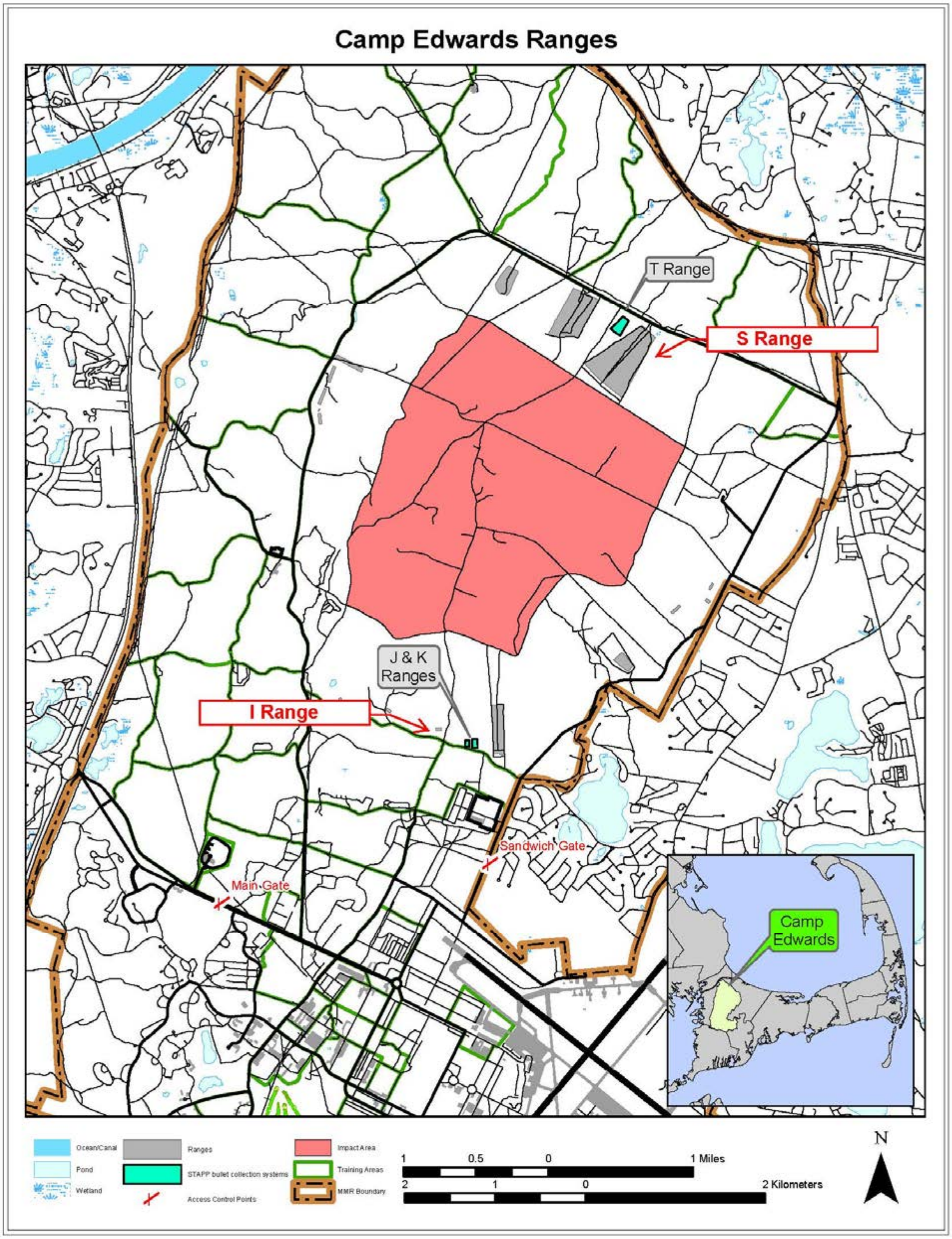

Camp Edwards Ranges
T Range
S Range
J & K
Ranges
I Range
Sandwich Gate
Main Gate
Camp
Edwards
Ocean/Canal
Pond
Wetland
Ranges
STAPP bullet collection systems
Access Control Points
Impact Area
Training Areas
MMR Boundary
1 0.5 0 1 Miles
2 1 0 2 Kilometers
N

Figure 2 - S Range Soil Sampling

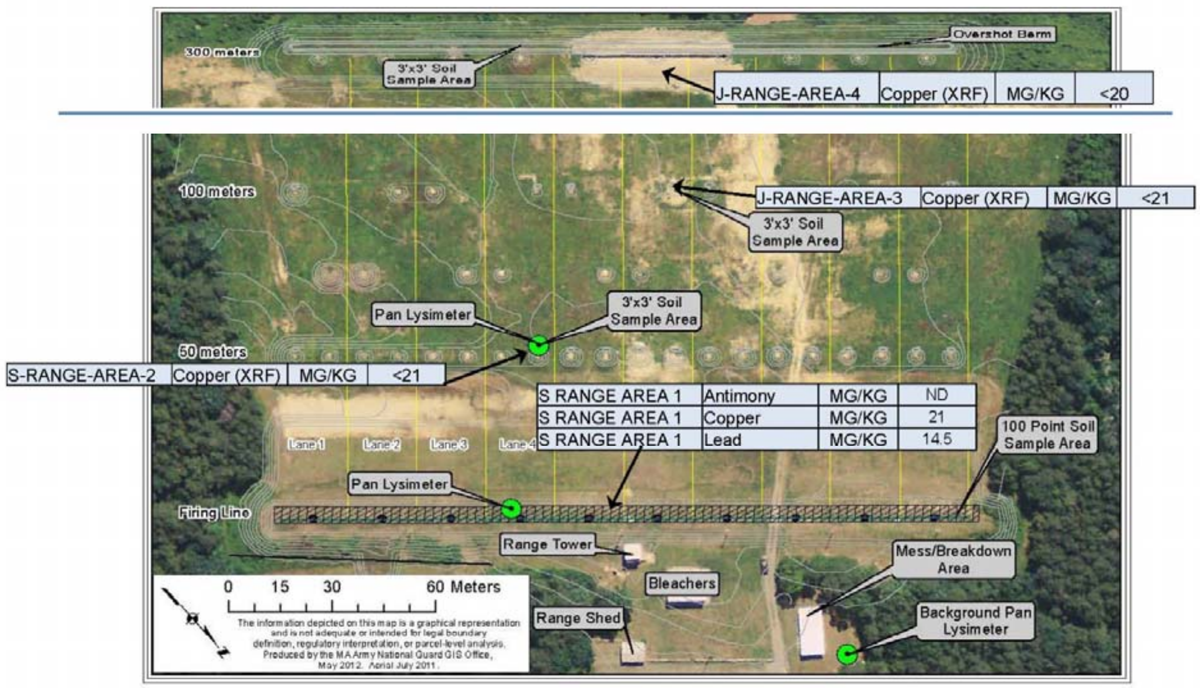
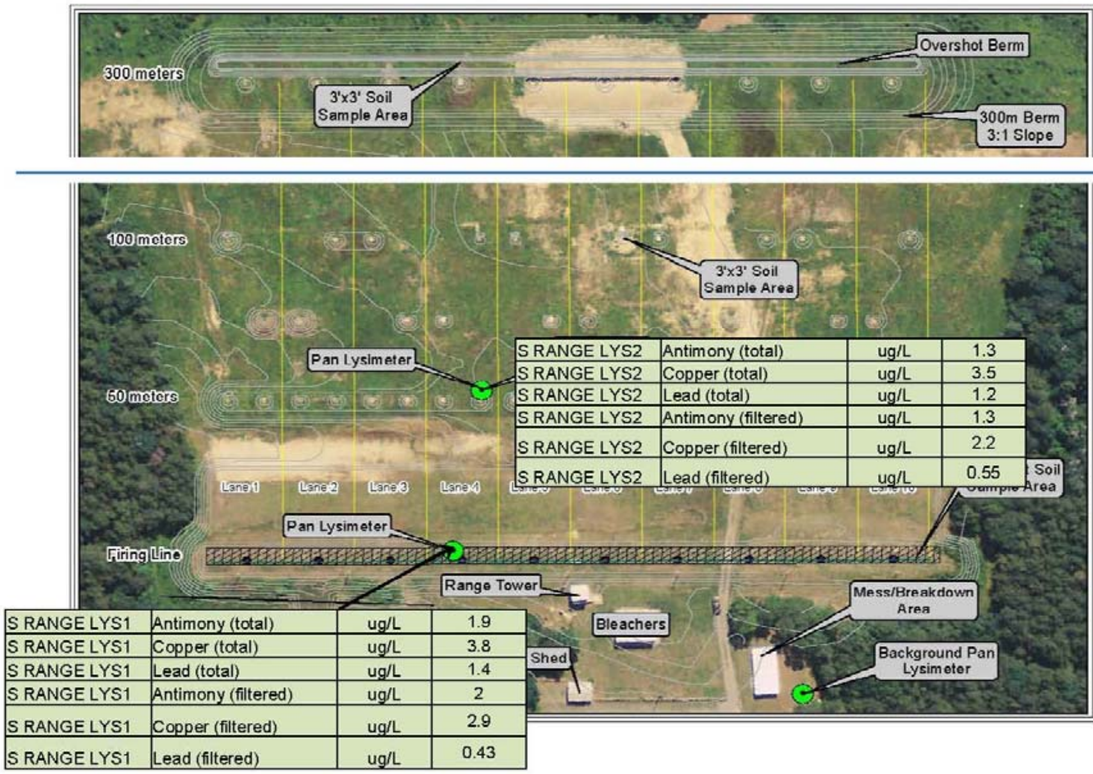


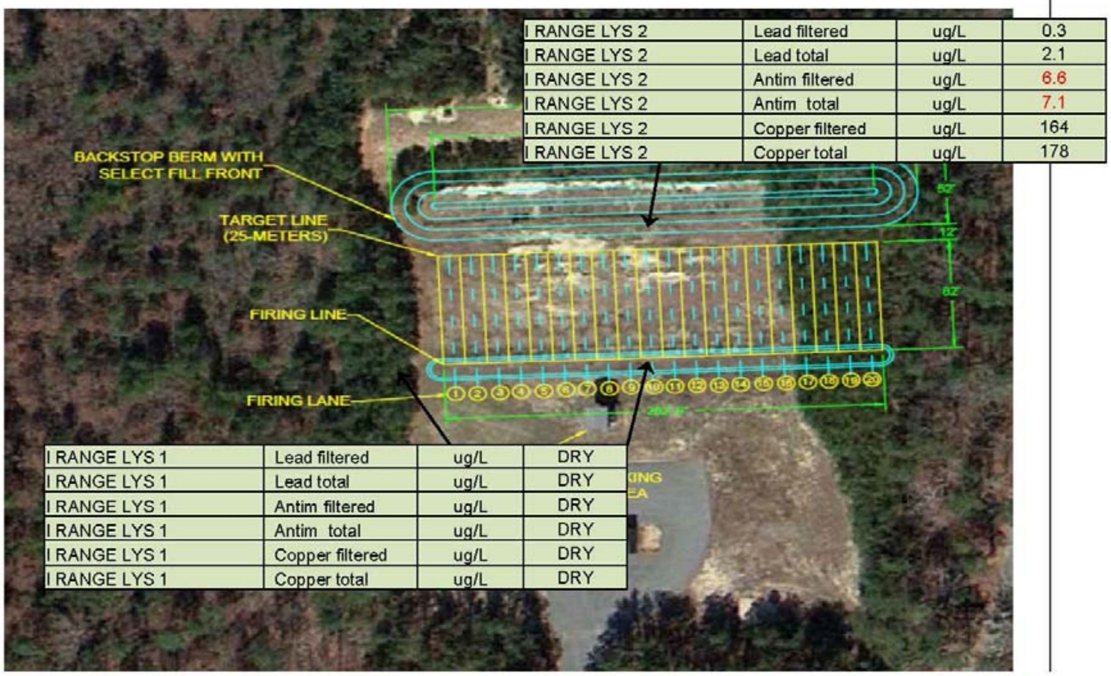
Figure 3 - S Range Pore Water Sampling



S RANGE LYS2	Antimony (total)	ug/L	1.3
S RANGE LYS2	Copper (total)	ug/L	3.5
S RANGE LYS2	Lead (total)	ug/L	1.2
S RANGE LYS2	Antimony (filtered)	ug/L	1.3
S RANGE LYS2	Copper (filtered)	ug/L	2.2
S RANGE LYS2	Lead (filtered)	ug/L	0.55

S RANGE LYS1	Antimony (total)	ug/L	1.9
S RANGE LYS1	Copper (total)	ug/L	3.8
S RANGE LYS1	Lead (total)	ug/L	1.4
S RANGE LYS1	Antimony (filtered)	ug/L	2
S RANGE LYS1	Copper (filtered)	ug/L	2.9
S RANGE LYS1	Lead (filtered)	ug/L	0.43

Figure 4 - I Range Pore Water



I RANGE LYS 2	Lead filtered	ug/L	0.3
I RANGE LYS 2	Lead total	ug/L	2.1
I RANGE LYS 2	Antim filtered	ug/L	6.6
I RANGE LYS 2	Antim total	ug/L	7.1
I RANGE LYS 2	Copper filtered	ug/L	164
I RANGE LYS 2	Copper total	ug/L	178

I RANGE LYS 1	Lead filtered	ug/L	DRY
I RANGE LYS 1	Lead total	ug/L	DRY
I RANGE LYS 1	Antim filtered	ug/L	DRY
I RANGE LYS 1	Antim total	ug/L	DRY
I RANGE LYS 1	Copper filtered	ug/L	DRY
I RANGE LYS 1	Copper total	ug/L	DRY

Figure 5 – S Range Groundwater Sampling

Figure 6
SOP Interim Action Levels

Surface Soil Action Levels

Analyte	
Lead	3,000 mg/Kg
Antimony	300 mg/Kg
Copper	10,000 mg/Kg

mg/kg= milligrams per kilograms or ppm

Pore Water Action Levels

Analyte	
Lead	15 ug/L
Antimony	6 ug/L
Copper	1300 ug/L

ug/L= micrograms per liter or ppb

Groundwater Action Levels

Analyte	
Lead	7.5 ug/L
Antimony	3 ug/L
Copper	650 ug/L

ug/L= micrograms per liter or ppb

TABLE 1
Small Arms Ranges Soil Sample Results
Fall 2012 Sampling Event

Site/SLX List	Location ID	Field Sample ID	Top Depth (ft bgs)	Bottom Depth (ft bgs)	Date Sampled	Test Method	Analyte	Result Value	Qualifier	Units	MDL	RL	Sample Type
SIERRA RANGE	SSSRNG001	SSSRNG001_SEP12A	0	0.25	09/12/2012	SW6010C	Antimony	ND	U	MG/KG	0.11	1.3	N1
SIERRA RANGE	SSSRNG001	SSSRNG001_SEP12A	0	0.25	09/12/2012	SW6010C	Copper	21		MG/KG	0.049	0.56	N1
SIERRA RANGE	SSSRNG001	SSSRNG001_SEP12A	0	0.25	09/12/2012	SW6010C	Lead	14.5		MG/KG	0.098	0.22	N1

ND/U = Non detect
J = Estimated Result
mg/kg = milligram/kilogram

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MDL = Method Detectin Limit
RL = Reporting Limit
N = Native Sample
FR = Field Replicate Sample

TABLE 2
S Range Soil Sample XRF Copper Results

S Range 5-point composite Samples	Copper (ppm)*	Three Readings**
Base of 50M backstop berm on Lane 4	< LOD	< 20
		< 21
		< 20
Base of 100M backstop berm on Lane 6	< LOD	< 21
		< 20
		< 19
Base of 320M berm beneath bullet pocket (Lane 4)	< LOD	< 19
		< 20
		< 20

* = XRF Copper results are reported as <LOD with an estimated LOD of 20 mg/kg.
** = Three reading were recorded on the homogenized 5-point soil composite.

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TABLE 3
Small Arms Range Lysimeter Sample Results
Fall 2012 Sampling Event

Site/SLX List	Location ID	Field Sample ID	Date Sampled	Test Method	Extraction Method	Analyte	Result Value	Qualifier	Units	MDL	RL
I RANGE	LYIRNG002	LYIRNG002_SEP12FA	09/11/2012	SW6020A	FLDFLT	Antimony	6.6	J	UG/L	0.073	20.0
I RANGE	LYIRNG002	LYIRNG002_SEP12FA	09/11/2012	SW6020A	FLDFLT	Copper	164		UG/L	0.23	20.0
I RANGE	LYIRNG002	LYIRNG002_SEP12FA	09/11/2012	SW6020A	FLDFLT	Lead	0.3	J	UG/L	0.024	2.0
I RANGE	LYIRNG002	LYIRNG002_SEP12UA	09/11/2012	SW6020A	TOTAL	Antimony	7.1	J	UG/L	0.073	20.0
I RANGE	LYIRNG002	LYIRNG002_SEP12UA	09/11/2012	SW6020A	TOTAL	Copper	178		UG/L	0.23	20.0
I RANGE	LYIRNG002	LYIRNG002_SEP12UA	09/11/2012	SW6020A	TOTAL	Lead	2.1		UG/L	0.024	2.0
I RANGE	LYIRNG001		09/11/2012			DRY - No Sample					
SIERRA RANGE	LYSRNG001	LYSRNG001_SEP12FA	09/13/2012	SW6020A	FLDFLT	Antimony	2	J	UG/L	0.073	20.0
SIERRA RANGE	LYSRNG001	LYSRNG001_SEP12FA	09/13/2012	SW6020A	FLDFLT	Copper	2.9	J	UG/L	0.23	20.0
SIERRA RANGE	LYSRNG001	LYSRNG001_SEP12FA	09/13/2012	SW6020A	FLDFLT	Lead	0.43	J	UG/L	0.024	2.0
SIERRA RANGE	LYSRNG001	LYSRNG001_SEP12UA	09/13/2012	SW6020A	TOTAL	Antimony	1.9	J	UG/L	0.073	20.0
SIERRA RANGE	LYSRNG001	LYSRNG001_SEP12UA	09/13/2012	SW6020A	TOTAL	Copper	3.8	J	UG/L	0.23	20.0
SIERRA RANGE	LYSRNG001	LYSRNG001_SEP12UA	09/13/2012	SW6020A	TOTAL	Lead	1.4	J	UG/L	0.024	2.0
SIERRA RANGE	LYSRNG002	LYSRNG002_SEP12FA	09/13/2012	SW6020A	FLDFLT	Antimony	1.3	J	UG/L	0.073	20.0
SIERRA RANGE	LYSRNG002	LYSRNG002_SEP12FA	09/13/2012	SW6020A	FLDFLT	Copper	2.2	J	UG/L	0.23	20.0
SIERRA RANGE	LYSRNG002	LYSRNG002_SEP12FA	09/13/2012	SW6020A	FLDFLT	Lead	0.55	J	UG/L	0.024	2.0
SIERRA RANGE	LYSRNG002	LYSRNG002_SEP12UA	09/13/2012	SW6020A	TOTAL	Antimony	1.3	J	UG/L	0.073	20.0
SIERRA RANGE	LYSRNG002	LYSRNG002_SEP12UA	09/13/2012	SW6020A	TOTAL	Copper	3.5	J	UG/L	0.23	20.0
SIERRA RANGE	LYSRNG002	LYSRNG002_SEP12UA	09/13/2012	SW6020A	TOTAL	Lead	1.2	J	UG/L	0.024	2.0
SIERRA RANGE	LYSRBGD01		09/13/2012			DRY - No Sample					

J = Estimated Result
ND/U = Non detect

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ug/l = microgram/liter
MDL = Method Detectin Limit
RL = Reporting Limit

TABLE 4
Small Arms Ranges Sampling
Fall 2012

Site/SLX List	Location ID	Field Sample ID	Date Sampled	Test Method	Extraction Method	Analyte	Result Value	Qualifier	Units	MDL	RL	Sample Type
I RANGE	LYIRNG002	LYIRNG002_NOV12UA	11/01/2012	SW6020A	TOTAL	Antimony	9.4	J	UG/L	0.073	20.0	N1
I RANGE	LYIRNG002	LYIRNG002_NOV12UD	11/01/2012	SW6020A	TOTAL	Antimony	8.5	J	UG/L	0.073	20.0	FD1

Table 4 LysimeterResample_Nov12.xlsx
November 17, 2012

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TABLE 5
Small Arms Range Groundwater Sample Results
Fall 2012 Sampling Event

Site/SLX List	Location ID	Field Sample ID	Top Depth (ft bgs)	Bottom Depth (ft bgs)	Date Sampled	Test Method	Analyte	Result Value	Qualifier	Units	MDL	RL
S RANGE	MW-465S	MW-465S_SEP12UA	136.26	146.26	09/17/2012	SW6020A	Antimony	ND	U	UG/L	0.073	20.0
S RANGE	MW-465S	MW-465S_SEP12UA	136.26	146.26	09/17/2012	SW6020A	Copper	0.42	J	UG/L	0.23	20.0
S RANGE	MW-465S	MW-465S_SEP12UA	136.26	146.26	09/17/2012	SW6020A	Lead	ND	U	UG/L	0.024	2.0
S RANGE	MW-466S	MW-466S_SEP12UA	132.95	142.95	09/17/2012	SW6020A	Antimony	ND	U	UG/L	0.073	20.0
S RANGE	MW-466S	MW-466S_SEP12UA	132.95	142.95	09/17/2012	SW6020A	Copper	0.32	J	UG/L	0.23	20.0
S RANGE	MW-466S	MW-466S_SEP12UA	132.95	142.95	09/17/2012	SW6020A	Lead	ND	U	UG/L	0.024	2.0
S RANGE	MW-466S	MW-466S_SEP12UD	132.95	142.95	09/17/2012	SW6020A	Antimony	ND	U	UG/L	0.073	20.0
S RANGE	MW-466S	MW-466S_SEP12UD	132.95	142.95	09/17/2012	SW6020A	Copper	0.31	J	UG/L	0.23	20.0
S RANGE	MW-466S	MW-466S_SEP12UD	132.95	142.95	09/17/2012	SW6020A	Lead	ND	U	UG/L	0.024	2.0

ug/L = microgram/liter

JULIET, KILO, AND TANGO RANGES 2013 ENVIRONMENTAL SAMPLING AND ANALYSIS REPORT

1.0 INTRODUCTION

Juliet, Kilo, and Tango Ranges at Camp Edwards are 25-meter small arms ranges (SARs) currently used for marksmanship training using lead ammunition under a pilot period approved by the US Environmental Protection Agency (EPA) and the Environmental Management Commission (EMC). The pilot period is intended to assess the STAPP bullet containment systems installed on these three ranges and determine if the ranges can be used for live firing with lead ammunition while protecting the groundwater. The pilot period has been extended at all three ranges by EPA and EMC until the end of calendar year 2013. Figure 1 shows the locations of J, K, and T Ranges within Camp Edwards.

As part of the pilot period, and in accordance with the conditions established by the EMC and the EPA for the Massachusetts Army National Guard (MAARNG) to fire lead ammunition, these ranges are operated and maintained as outlined in the Best Management Practices and Operation, Maintenance and Monitoring Plan (OMMP) for Juliet, Kilo, and Tango Ranges at Camp Edwards, Massachusetts which was approved in September 2012. That OMMP superseded the range-specific OMMPs dated 23 January, 2009.

The OMMP includes a program of periodic sampling of soil, pore water, and groundwater. The samples are analyzed for select metals that are commonly used in ammunition. Soil samples and pore water samples are also field screened for pH which is an important parameter for determining the mobility of certain metals in the environment. The goal of this monitoring program is to determine when routine maintenance activities are needed to promote range sustainability and to protect groundwater.

This report summarizes the environmental monitoring that was conducted by the MAARNG in 2013 as prescribed in the 5 September 2012 version of the OMMP.

2.0 RANGE USE SUMMARY

2.1 J Range

J Range has been used as a SAR since the 1980s. Investigations of soil and groundwater were completed by the Impact Area Groundwater Study Program (IAGWSP) and the Final Juliet (J) Range Soil and Groundwater Investigation Report was completed in September 2008. Levels of nitroglycerine and lead that indicated deposition from range use were detected in soil. However, these analytes were not detected in groundwater. The MAARNG decided to remove surface soils from the range and regrade it in 2008 and a STAPP bullet collection system was installed. The range floor was completely re-graded and reconstructed to improve drainage in 2010. Three pan lysimeters were installed on the range in 2010 to monitor pore water percolating through the soil. The pilot period commenced on J Range in 2009. Approximately 181,200 bullets were fired into the STAPP system since 2009. This report summarizes the fifth round of operational samples collected under the OMMP at J Range.

2.2 K Range

K Range has been used as a SAR since the 1980s. Investigations of soil and groundwater were completed by the IAGWSP and the Final Kilo (K) Range Soil and Groundwater Investigation Report was completed in September 2008. Levels of nitroglycerine and lead that indicated deposition from range use were detected in soil. However, these analytes were not detected in groundwater. The MAARNG regraded the range and installed a STAPP bullet collection system in 2008. The range floor was completely re-graded and reconstructed to improve drainage in 2010. Three pan lysimeters were installed on the range in 2010 to monitor pore water percolating through the soil. The pilot period commenced on K Range in 2009. Approximately 348,700 were fired into the STAPP System since 2009. This report summarizes the fifth round of operational samples collected under the OMMP at K Range.

2.3 T Range

T Range has been used as a SAR since the 1980s. Investigations of soil and groundwater were completed by the IAGWSP and the Draft Final T Range Soil and Groundwater Investigation Report was completed by the IAGWSP in June 2007. Levels of nitroglycerine and lead were detected in soil that indicated deposition from range use. However, these analytes were not detected in groundwater. The MAARNG re-graded surface soils from the mounded firing line, in effect raising the 25-meter firing line and improving the angle of fire into the STAPP system. The area between the firing line and the new berm were not excavated or regraded. The STAPP bullet collection system was installed in 2006. Several suction lysimeters were installed in 2007 to monitor pore water percolating through the soil for tungsten. These were removed after sampling in 2010 because of concerns with the quality and representativeness of the samples. Three pan lysimeters were installed on the range in 2010. The pilot period commenced in 2008. Operational samples were first collected under the OMMP in 2008. Approximately 313,000 bullets have been fired into the STAPP System since 2008.

3.0 MONITORING REQUIREMENTS AND RESULTS

3.1 Surface Soil

The soil sampling at J, K, and T Ranges includes multi-increment sampling (MIS) from 6 sample areas on each range on alternating years. The sample areas are laid out in strips across the width of the ranges from the firing lines to the backstop berms so that the impact of deposition at the firing lines, the target areas, and the areas in between could be separately quantified.

Soil samples were collected from K and T ranges in July-August 2013. J Range was sampled in 2012 and will be sampled again in 2014.

One hundred-point composite samples were collected from each sample area from a depth of 0 to 3 inches below ground surface (bgs). Two replicate 100-point samples were also collected from Area 1 on both K and T Ranges. All samples were submitted to Test America Laboratory, Inc. in Burlington, Vermont for analysis. All samples were ground and processed in accordance with Method 8330B. Soil samples were analyzed by method 6010C for antimony, copper, and lead. Soil sampling locations are shown on Figures 2 and 3 and analytical results are summarized in Table 1.

Soil pH readings were collected from the range floors at J, K, and T Ranges by Range Control personnel in April and October 2013. Soil pH on all three ranges were within the desired range of 6 to 8.5 during both testing events. Copies of the Range Control pH monitoring data sheets are provided as Attachment 1.

Lime has been applied several times from the firing line to approximately 5 meters forward. Lime has also been applied between the STAPP systems and the toe boxes. Lime was last spread on J, K, and T Ranges in November 2012. As per the agreement of the Small Arms Range Working Group (SARWG) on December 12, 2013, in response to antimony detections in some pore water samples further lime additions will occur only upon consultation with the SARWG.

3.2 Pore Water Sampling

Pore water samples were collected from the pan lysimeters installed on J, K, and T Ranges in July-August 2013. All pan lysimeters are installed approximately 2 feet below the ground surface. All pore water samples were analyzed by method 6020A for antimony, copper, and lead. Samples were not filtered prior to analysis. The locations of the lysimeters are shown on Figures 4, 5 and 6. Analytical results are summarized in Table 2.

The background lysimeter near T Range (LYTBGD001) was sampled in July/August 2014 but no water could be collected from the other two background lysimeters (LYSBGD001 and LYKBGD001). Those lysimeters will be reset prior to the next sample collection.

Due to unexpected detections of antimony in several lysimeters during September 2012 and November 2012 sampling events, pore water from all of the lysimeters was resampled and analyzed for antimony in February 2013. Duplicate samples were also collected from each lysimeter and sent to another laboratory (Con-test Analytical) to double check the validity of the laboratory results. The results from both labs showed essentially the same thing with elevated levels of antimony in the same few lysimeters where it was previously detected. Analytical results from both sets of February 2013 samples are summarized in Table 3 and shown on Figures 7, 8, and 9.

During both rounds of pore water sampling (February and July-August 2013), pH readings were taken from the pore water during sampling of the lysimeters. The pH readings in February ranged from 5.5 to 7.4 as summarized in the table below. The pH readings in July-August ranged from 5.2 to 6.5. The previous readings are also included in the table for comparison. The average pore water pH across the three ranges has dropped from 8.0 in 2011 to 5.9 at present.

	LOCID	July-August 2013	February 2013	Nov 2012	Sept 2012	Oct 2011
	LYJRNG001	6.4	6.7	NS	6.7	8.6
	LYJRNG002	6.4	7.1	NS	6.5	7.6
	LYJRNG003	6.5	7.2	8.65	6.6	8.0
	LYKRNG001	5.6	5.6	NS	6.4	No H2O
	LYKRNG002	5.5	5.5	NS	5.7	7.6
	LYKRNG003	6.3	7.4	5.66	6.4	9.0
	LYKRNG004	6.3	6.8	6.66	6.3	No H2O
	LYTRNG011	5.7	6.3	NS	6.0	7.0
	LYTRNG012	5.2	5.6	NS	5.6	No H2O
	LYTRNG013	5.5	6.1	NS	6.3	8.1
	LYTBGD001	5.8*	NS	NS	NS	NS
	Average	**5.9**	**6.4**	**7.0**	**6.3**	**8.0**

NS= not sampled.

*= Value not included in calculation of Averages.

3.3 Groundwater

Groundwater monitoring well locations are shown on Figures 4, 5, and 6. Groundwater samples were collected from all five wells in the monitoring program (MW-471s, MW-472s, MW-474s, MW-467s) in July-August 2013. Well MW-473s at K Range was also included for one more round even though it was no longer required under the current scope of the OMMP. Only unfiltered (total metals) samples were collected during this sampling round. Samples were

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analyzed by method 6020A for antimony, copper, and lead. No significant concentrations of metals were detected in any of the wells. Results are summarized in Table 4.

3.4 STAPP System Water

Sampling of the water in the STAPP systems was not needed during this reporting period.

3.5 Surface Water

Outside the scope of the OMMP but included as part of the investigation of elevated antimony levels in several of the lysimeters, surface water samples were collected from standing water in the drainage swales on J and K Ranges on January 31, 2013 immediately after a significant rainfall. These samples were analyzed for antimony. Surface water results are summarized in Table 5 and shown on Figures 7 and 8.

Elevated levels of antimony up to 13.2 ppb were detected in the surface water from the swale near the right side of the K Range berm near LYKRNG003. This drainage swale collects water from the area of the berm and the STAPP system. The antimony concentration in surface water near LYKRNG003 was similar to the pore water concentration indicating a potential link between antimony in storm water and pore water. The source of antimony in the storm water has not been determined.

No antimony was detected in the surface water swale on J Range. That swale collects surface water from the range floor and is not likely to be impacted by the berm or STAPP system. There was no surface water present in the swale above J Range lysimeter LYJRNG003 when samples were collected so samples were not collected at that location.

4.0 COMPARISON TO OMMP ACTION LEVELS

The September 2012 version of the combined J, K, and T Ranges OMMP lists action levels for soil, pore water, and groundwater concentrations that trigger response actions. Action levels have been assigned for antimony, copper, and lead. The action levels are summarized on Figure 10.

4.1 Soil

No action levels were exceeded in soil samples collected at K and T Ranges in 2013. J Range was not sampled in 2013.

4.2 Pore Water

The action level for antimony in pore water (6 ppb) was exceeded in lysimeter LYJRNG003 at J Range and lysimeters LYKRNG003 and LYKRNG004 at K Range. All of these lysimeters are located in or near the drainage swales on these ranges.

Because the exceedences of the antimony action level for pore water were expected based on similar previous sampling results, re-sampling of these lysimeters after the July-August 2013 sampling round was not needed. Further investigation of the cause of these elevated antimony concentrations is currently ongoing.

No action levels were exceeded in the pore water at T Range.

4.3 Groundwater

No action levels were exceeded in the groundwater monitoring wells at J Range.

No action levels were exceeded in the groundwater monitoring wells at K Range.

No action levels were exceeded in the groundwater monitoring wells at T Range.

5.0 COMPARISON WITH PREVIOUS SAMPLING RESULTS

5.1 Soil

Soil sampling at K Range started in October 2010 after reconstruction of the range including complete replacement of the range floor. Lead concentrations at K range have remained steady and similar to background concentrations with no clear pattern emerging.

Soil sampling started on T Range in 2008 before the firing line was re-graded. The first round of samples that are comparable to current conditions are the 2010 samples. Lead concentrations in areas where soil was replaced during the reconstruction of T range in 2006 remain similar to background concentrations while concentrations in the middle of the range floor, which was not disturbed during reconstruction, have remained elevated. Concentrations in soil near the berm continue to be similar to background concentrations. Overall, the average concentration of lead on T Range has dropped while the average lead concentration on K Range has remained stable. As summarized in the table below, lead concentrations at T range in 2013 were the lowest overall in four rounds of sampling. Average lead concentrations for each range are calculated using the average of three replicate values in Area 1 at each range along with the results of the other 5 sample areas.

Average lead concentrations, ppm					
	Oct-10	May-11	Oct-11	Sept-12	July/Aug 2013
J Range	44	53	50	34	Not Sampled
K Range	24	23	27	Not Sampled	23
T Range	212	165	207	Not Sampled	105

5.2 Pore Water

The pore water lysimeters at J, K, and T Ranges have been sampled 6 times under the OMMPs: October 2010, May 2011, October 2011, September 2012, February 2013, and July/August 2013. In addition, samples were collected from the three lysimeters with antimony concentrations exceeding the action level (6 ppb) in November 2012. Method 6010 was used to analyze for metals during the first monitoring event, the more sensitive method 6020A has been used since May 2011. The typical minimum detection level (MDL) for antimony dropped from 3.6 ppb to 0.073 ppb with the change in analytical method.

Copper, lead, and antimony have all been detected in various lysimeters during pore water sampling events since the first pan lysimeter samples were collected in 2010. However, the detections are often not repeated in subsequent events. For example, in May 2011, the highest lead concentration in pore water to date was detected at 9 ppb in lysimeter LYJRNG003 on J Range. No lead was detected in this lysimeter in October 2011 and only low concentrations, barely above the detection limit, were detected in September 2012 and July/August 2013.

Antimony was detected at significant concentrations in lysimeters for the first time during the September 2012 monitoring. It has been consistently detected at concentrations above the action level in lysimeters in the drainage swales at J and K Ranges since that time. Charts showing the antimony, lead, and copper concentrations in pore water during OMMP sampling are included as Attachment 2. Note that the excel graphing function only recognizes numbers so results which were below the minimum detectable levels are reported as 0 ppb on the charts even thought the analytical method is not capable of quantifying concentrations below the MDL.

A slight decrease in antimony concentrations is apparent in all of the antimony-impacted lysimeters in July-August 2013. The cessation of lime amendments since November 2012 may be a factor in the slight decrease evident in the July/Aug 2013 data.

The analysis of four rounds of background pore water sampling near T Range indicate antimony concentrations as high as 1.5 ppb, copper as high as 1.6 ppb, and lead as high as 0.22 ppb. Similar concentrations of these metals detected in lysimeters on the ranges may tentatively be expected to be background concentrations. Prior to the July-August 2013 sampling event, background lysimeter LYTBGD01 was purged and pelletized lime was applied to the ground surface above to see if lime caused a change in background concentrations. Based on the 2013 sampling results, it did not appear to have any impact. A more complete report of background pore water concentrations at these Small Arms Ranges is expected to be complete in 2014.

5.3 Groundwater

The groundwater wells at J, K, and T Ranges have been sampled five times under the OMMPs: October 2010, May 2011, October 2011, September 2012, and July/August 2013. Method 6010 was used to analyze for metals during the first monitoring event, the more sensitive Method 6020A has been used since May 2011. Results of the groundwater analyses since 2011 are included in Table 4.

As with the pore water sampling, the reduced detection limits of method 6020A have lead to frequent detections of low concentrations of metals. These could be representative of background conditions, but a study of background metals concentrations in groundwater near the SARs has not been attempted.

All antimony concentrations detected during this sampling round were below the reporting limit of the analysis. Several samples are flagged with a B to note that antimony was detected in method blanks prepared at the laboratory. Antimony was detected at a concentration of 0.155 ppb in the blank. This level of interference can be expected to be present in the antimony analyses of the B flagged samples. After taking this into consideration, the antimony concentrations detected in 2013 are very similar to those previously detected and all concentrations are below the level of concern. No trends are apparent in the antimony groundwater concentrations.

Concentrations of copper were somewhat higher in some wells in 2013 than they have been in past sampling rounds but still remain below levels of concern. The concentration in MW-467S at T Range was considerably higher than in the 2012 sampling round. This may be indicative of sediment in this sample. Sediment has been suspected of causing elevated metals concentrations in this well in the past (March 2010).

In well MW-467S at T Range the increased lead concentration mirrors the increase in copper indicating that sediment may have been present in the sample. This is the only lead result where the concentration was above the reporting limit of the analysis. While an increasing trend is apparent in the lead concentrations at this well, the cause is likely to be sediment.

6.0 REPEATABILITY OF REPLICATE SOIL SAMPLES

Repeatability of a sampling program is assessed through the collection and analysis of replicate samples from the same sample area. The Relative Standard Deviation (RSD) of the replicates is calculated and compared to a quality goal. The RSD= the standard deviation of the three replicate results divided by the average of the three results expressed as a percentage. EPA has indicated a preference for RSDs of 25% or less for sampling at J, K, and T Ranges.

Replicate samples were collected from Area 1 at K Range and Area 1 at T Range during 2013. The RSD for lead at Area 1 K Range was 9% and for copper the RSD was 11% so the repeatability was acceptable. Concentrations of antimony were not detected in the three replicate samples from Area 1.

The RSD for lead at Area 1 T Range was 3% and for copper the RSD was 6% so the repeatability was acceptable. Concentrations of antimony were not detected in the three replicate samples from Area 1.

The low RSDs discussed above are similar to previous results. It is apparent that the sampling protocol in use at the ranges provides consistent and repeatable results.

7.0 FURTHER ACTION

Comparison of the detected soil and groundwater concentrations to the action levels in the OMMP indicate that no range maintenance actions are needed at this time.

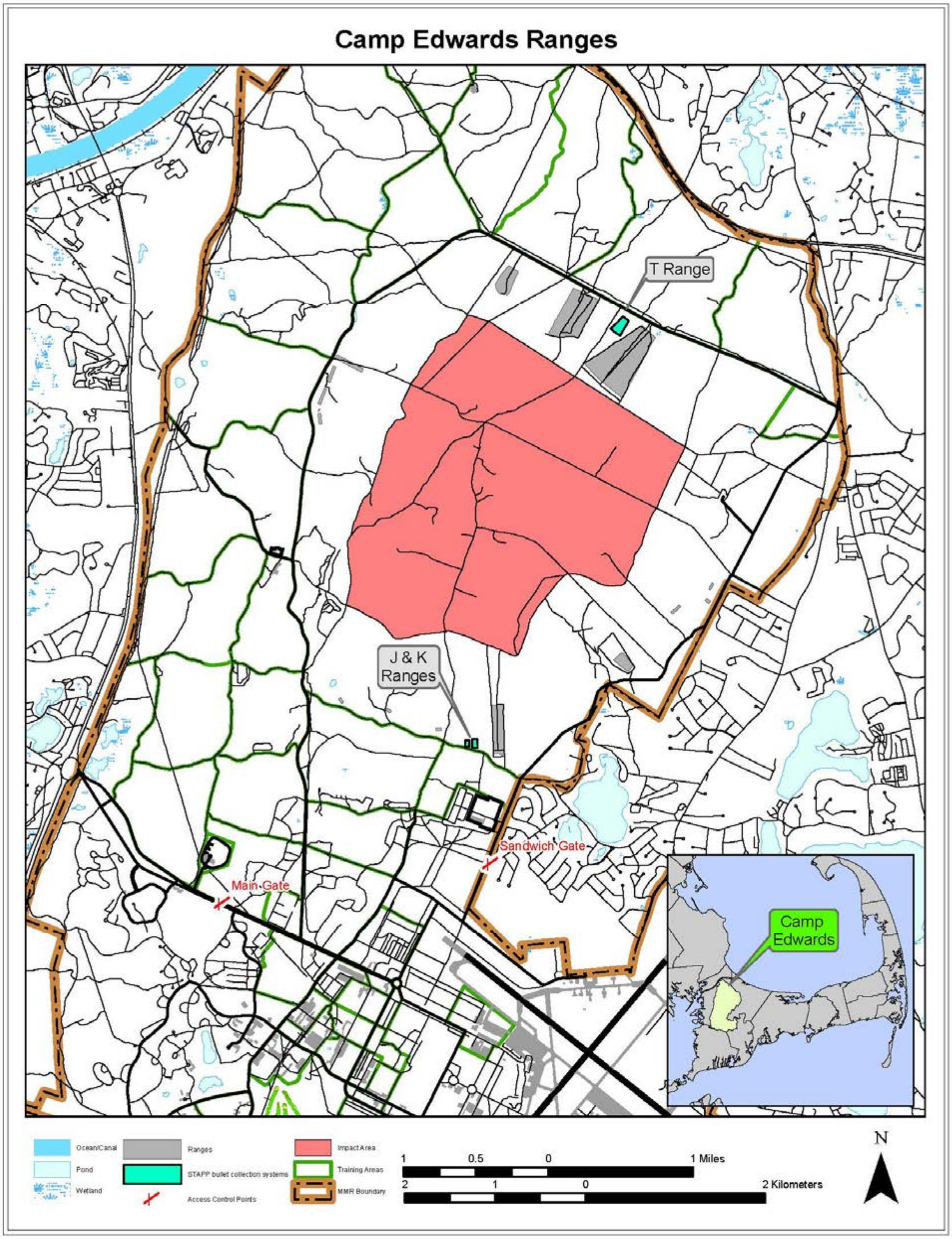
Elevated detections of antimony at levels exceeding the action level in three of the lysimeters have now been confirmed in several consecutive sampling rounds. Further investigation to determine potential causes of the antimony in the pore water is planned. On advice from the Science Advisory Council of the EMC, Camp Edwards has stopped trying to adjust soil and pore water pH concentrations via additions of lime to the ground surface. The Small Arms Ranges Working Group, including MAARNG, EPA and MassDEP, agreed that additions of lime would be stopped.

The background lysimeter near K Range will be reset and sampled in summer 2014.

A revision of the OMMP is in progress. The revision will likely include provisions to end the routine application of lime and reduce the pH soil and pore water screening to an annual frequency.

Soil (from J Range only), pore water, and groundwater samples will be collected again in the summer of 2014.

FIGURES


Camp Edwards Ranges
T Range
J & K Ranges
Sandwich Gate
Main Gate
Camp Edwards
Ocean/Canal
Pond
Wetland
Ranges
STAPP bullet collection systems
Access Control Points
Impact Area
Training Areas
MMR Boundary
1 0.5 0 1 Miles
2 1 0 2 Kilometers
N

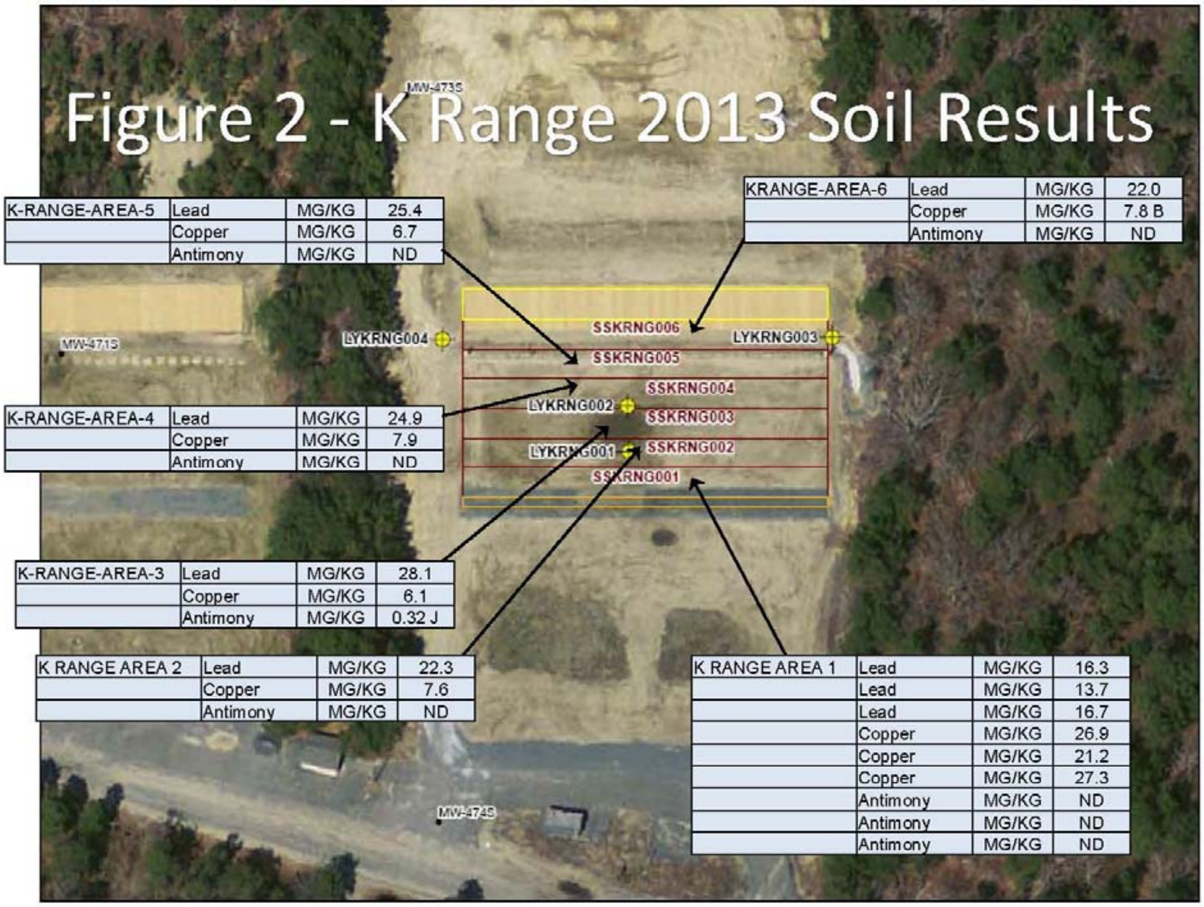


Figure 2 - K Range 2013 Soil Results
MW-473S
KRANGE-AREA-6 Lead MG/KG 22.0
Copper MG/KG 7.8 B
Antimony MG/KG ND
K-RANGE-AREA-5 Lead MG/KG 25.4
Copper MG/KG 6.7
Antimony MG/KG ND
MW-471S
LYKRNG004
SSKRNG006
LYKRNG003
SSKRNG005
SSKRNG004
LYKRNG002
SSKRNG003
LYKRNG001
SSKRNG002
SSKRNG001
K-RANGE-AREA-4 Lead MG/KG 24.9
Copper MG/KG 7.9
Antimony MG/KG ND
K-RANGE-AREA-3 Lead MG/KG 28.1
Copper MG/KG 6.1
Antimony MG/KG 0.32 J
K RANGE AREA 2 Lead MG/KG 22.3
Copper MG/KG 7.6
Antimony MG/KG ND
K RANGE AREA 1 Lead MG/KG 16.3
Lead MG/KG 13.7
Lead MG/KG 16.7
Copper MG/KG 26.9
Copper MG/KG 21.2
Copper MG/KG 27.3
Antimony MG/KG ND
Antimony MG/KG ND
Antimony MG/KG ND
MW-474S

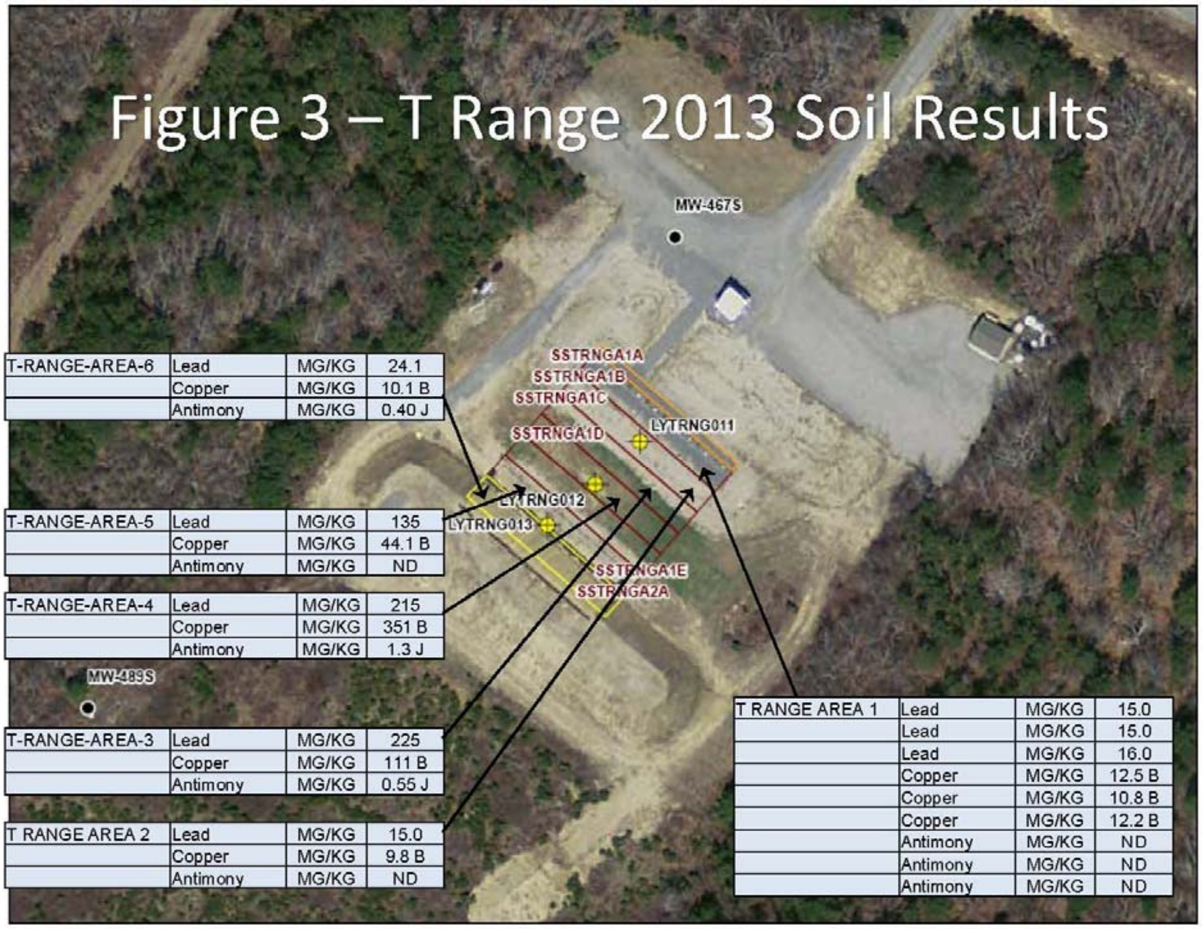


Figure 3 – T Range 2013 Soil Results
MW-467S
SSTRNGA1A
SSTRNGA1B
SSTRNGA1C
SSTRNGA1D
LYTRNG011
LYTRNG012
LYTRNG013
SSTRNGA1E
SSTRNGA2A
MW-489S
T-RANGE-AREA-6 Lead MG/KG 24.1
Copper MG/KG 10.1 B
Antimony MG/KG 0.40 J
T-RANGE-AREA-5 Lead MG/KG 135
Copper MG/KG 44.1 B
Antimony MG/KG ND
T-RANGE-AREA-4 Lead MG/KG 215
Copper MG/KG 351 B
Antimony MG/KG 1.3 J
T-RANGE-AREA-3 Lead MG/KG 225
Copper MG/KG 111 B
Antimony MG/KG 0.55 J
T RANGE AREA 2 Lead MG/KG 15.0
Copper MG/KG 9.8 B
Antimony MG/KG ND
T RANGE AREA 1 Lead MG/KG 15.0
Lead MG/KG 15.0
Lead MG/KG 16.0
Copper MG/KG 12.5 B
Copper MG/KG 10.8 B
Copper MG/KG 12.2 B
Antimony MG/KG ND
Antimony MG/KG ND
Antimony MG/KG ND

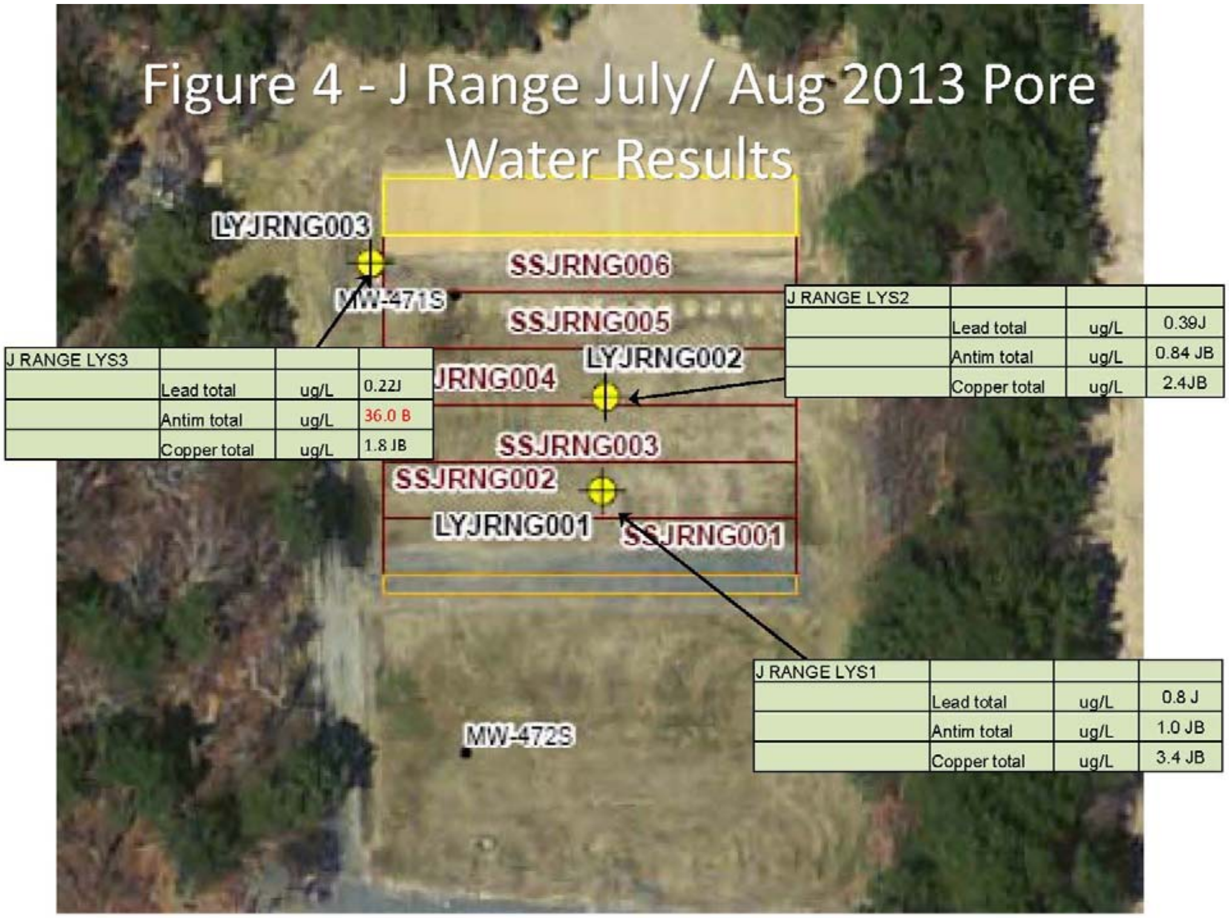


Figure 4 - J Range July/ Aug 2013 Pore Water Results
LYJRNG003
MW-471S
SSJRNG006
SSJRNG005
LYJRNG002
JRNG004
SSJRNG003
SSJRNG002
LYJRNG001
SSJRNG001
MW-472S
J RANGE LYS3
Lead total ug/L 0.22J
Antim total ug/L 36.0 B
Copper total ug/L 1.8 JB
J RANGE LYS2
Lead total ug/L 0.39J
Antim total ug/L 0.84 JB
Copper total ug/L 2.4JB
J RANGE LYS1
Lead total ug/L 0.8 J
Antim total ug/L 1.0 JB
Copper total ug/L 3.4 JB

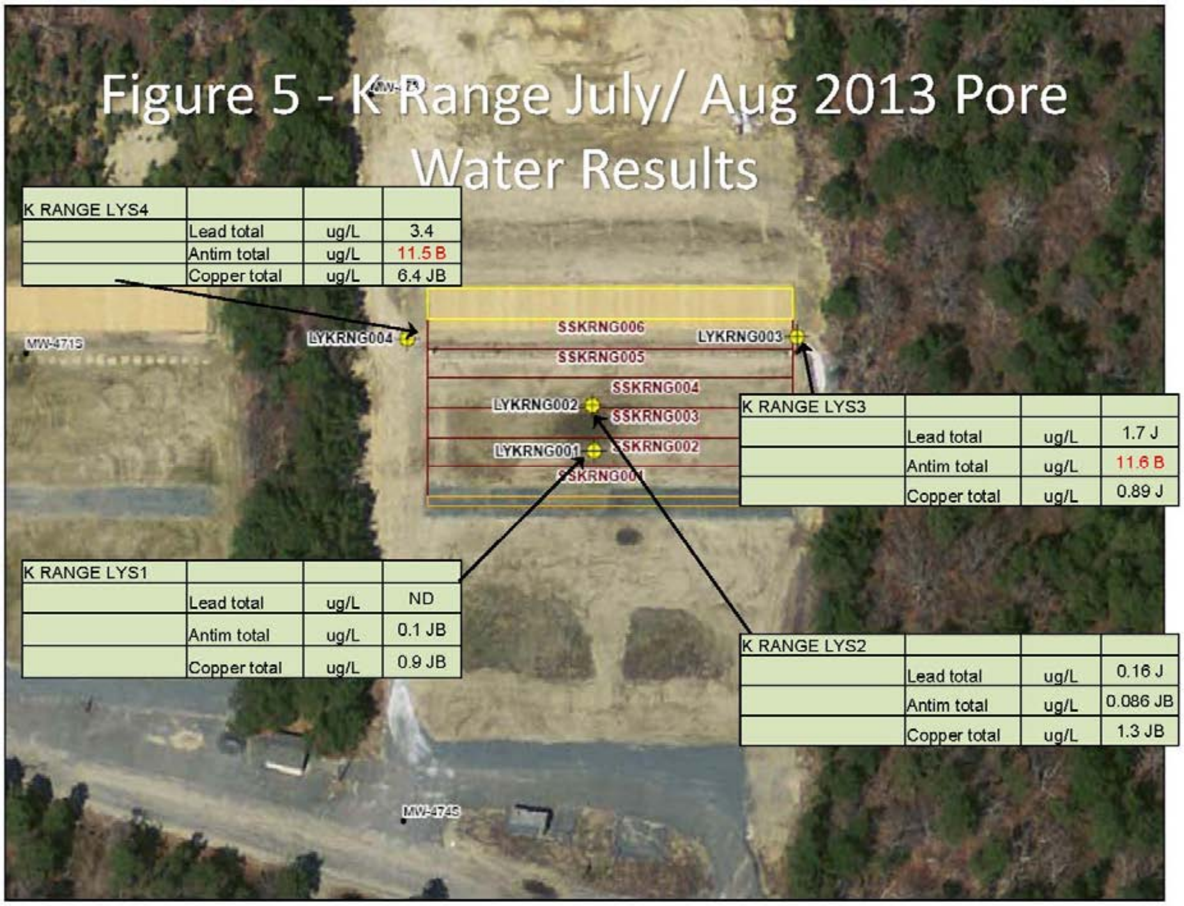


Figure 5 - K Range July/ Aug 2013 Pore Water Results
MW-471S
LYKRNG004
LYKRNG003
LYKRNG002
LYKRNG001
SSKRNG006
SSKRNG005
SSKRNG004
SSKRNG003
SSKRNG002
SSKRNG001
MW-474S
K RANGE LYS4
Lead total ug/L 3.4
Antim total ug/L 11.5 B
Copper total ug/L 6.4 JB
K RANGE LYS3
Lead total ug/L 1.7 J
Antim total ug/L 11.6 B
Copper total ug/L 0.89 J
K RANGE LYS1
Lead total ug/L ND
Antim total ug/L 0.1 JB
Copper total ug/L 0.9 JB
K RANGE LYS2
Lead total ug/L 0.16 J
Antim total ug/L 0.086 JB
Copper total ug/L 1.3 JB

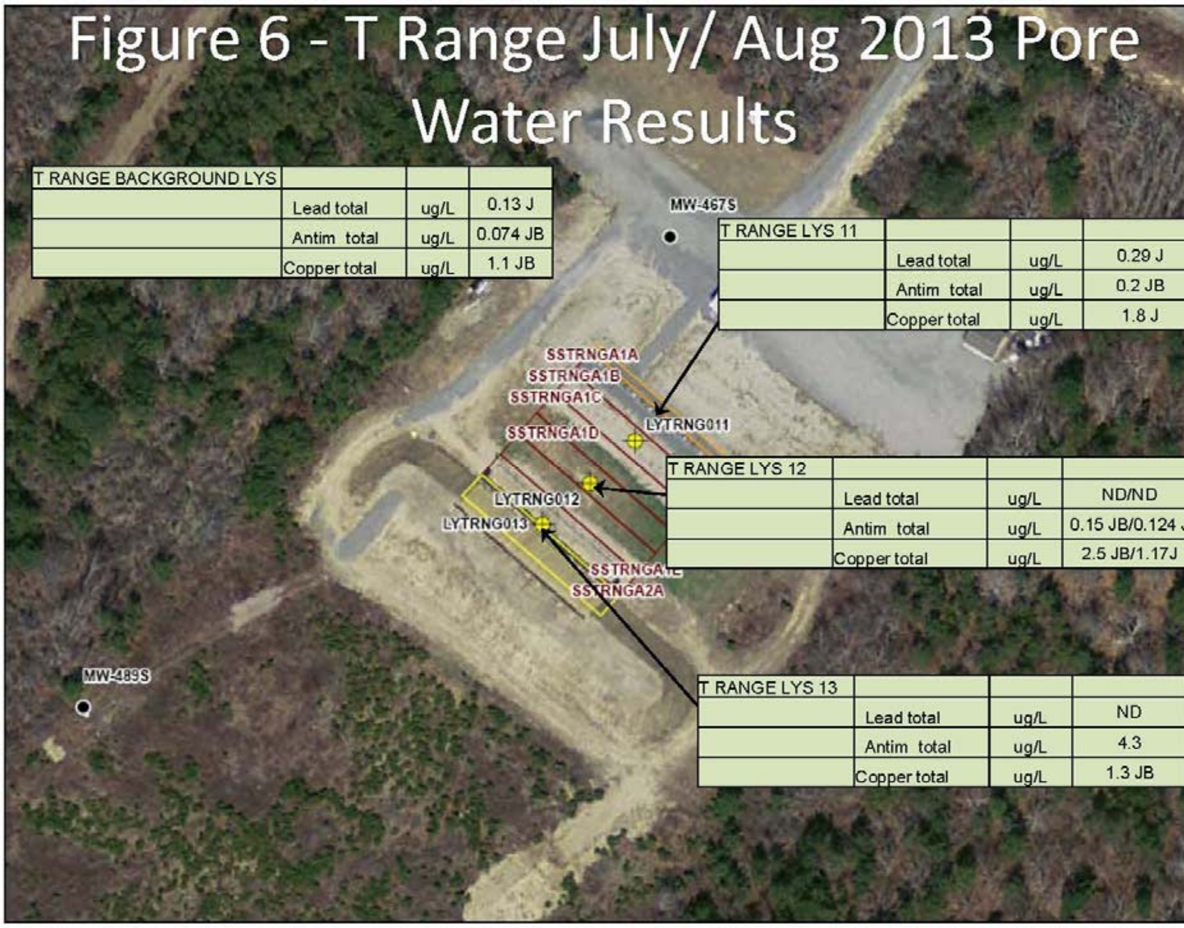
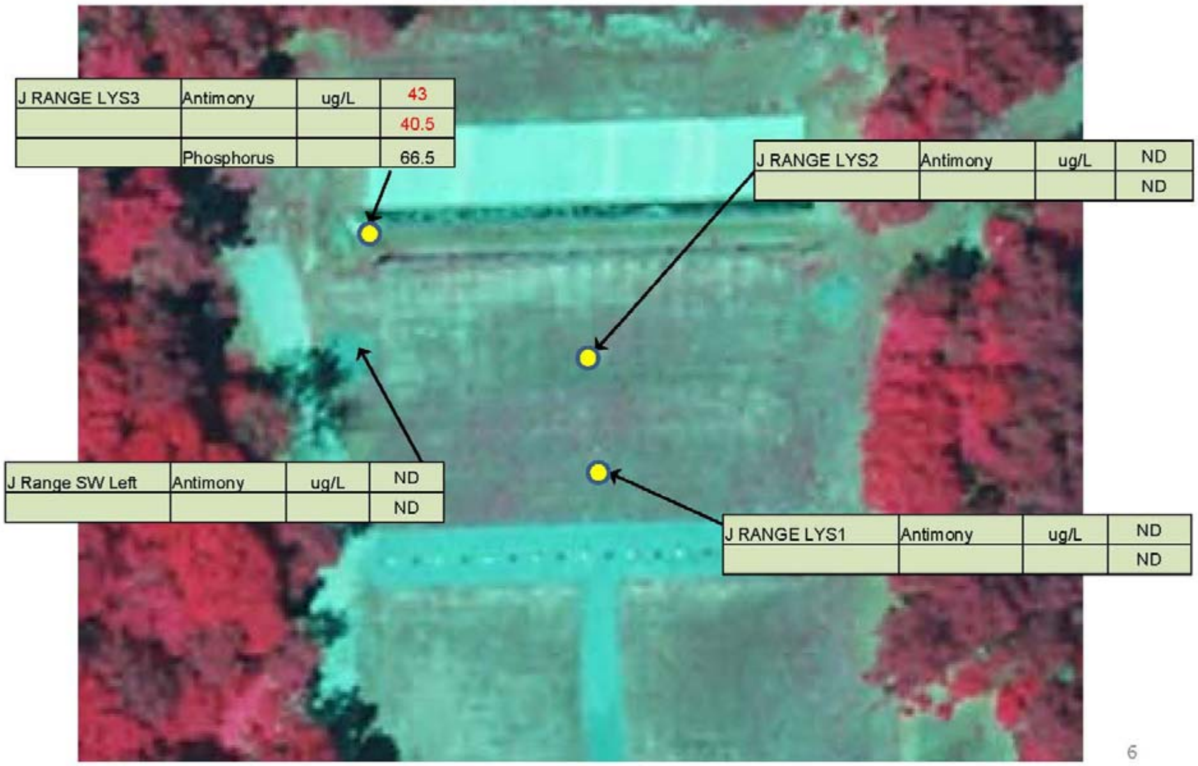


Figure 6 - T Range July/ Aug 2013 Pore Water Results
T RANGE BACKGROUND LYS
Lead total ug/L 0.13 J
Antim total ug/L 0.074 JB
Copper total ug/L 1.1 JB
MW-467S
T RANGE LYS 11
Lead total ug/L 0.29 J
Antim total ug/L 0.2 JB
Copper total ug/L 1.8 J
SSTRNGA1A
SSTRNGA1B
SSTRNGA1C
SSTRNGA1D
LYTRNG011
T RANGE LYS 12
Lead total ug/L ND/ND
Antim total ug/L 0.15 JB/0.124 J
Copper total ug/L 2.5 JB/1.17J
LYTRNG012
LYTRNG013
SSTRNGA2A
MW-489S
T RANGE LYS 13
Lead total ug/L ND
Antim total ug/L 4.3
Copper total ug/L 1.3 JB

Figure 7 J Range Pore Water Sampling Results Jan-Feb 2013



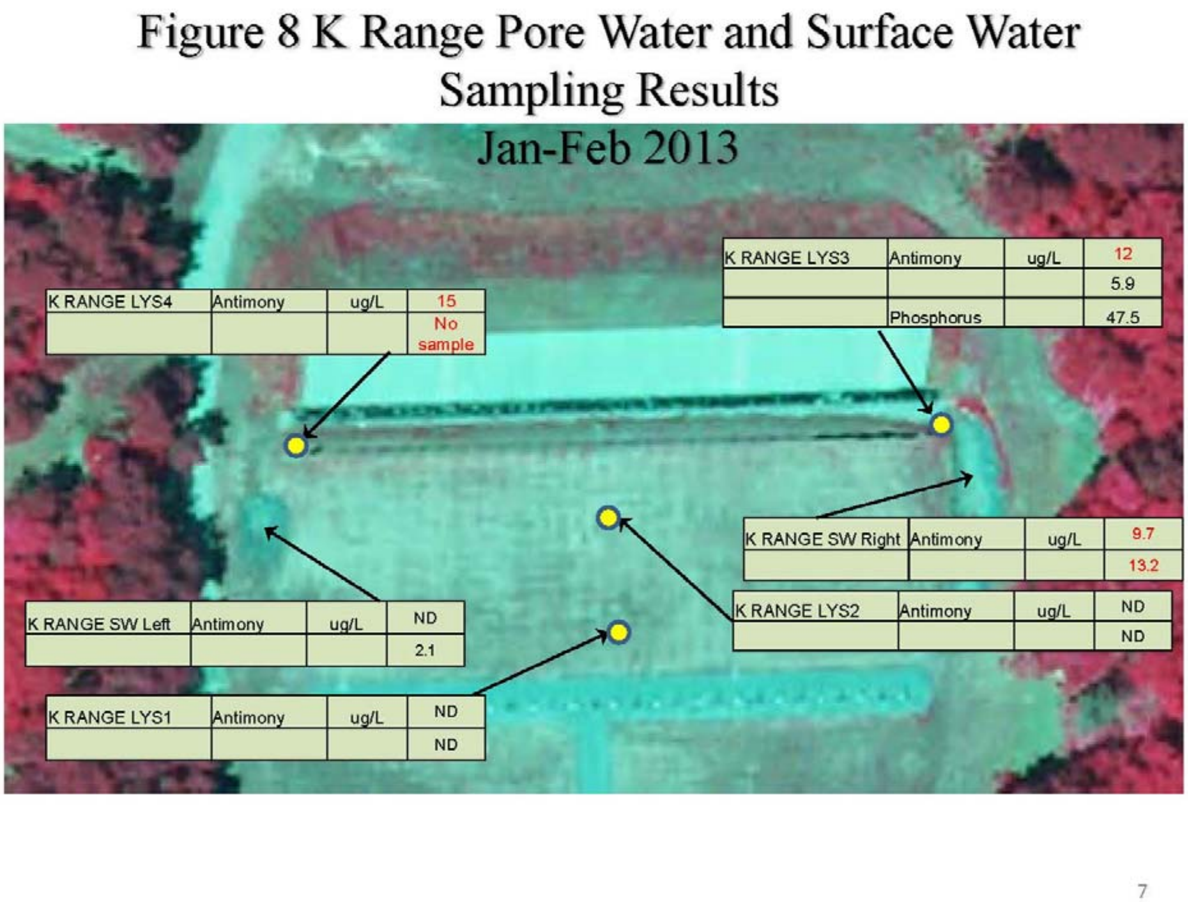


Figure 8 K Range Pore Water and Surface Water Sampling Results
Jan-Feb 2013
K RANGE LYS4 Antimony ug/L 15
No sample
K RANGE LYS3 Antimony ug/L 12
5.9
Phosphorus 47.5
K RANGE SW Right Antimony ug/L 9.7
13.2
K RANGE LYS2 Antimony ug/L ND
ND
K RANGE SW Left Antimony ug/L ND
2.1
K RANGE LYS1 Antimony ug/L ND
ND
7

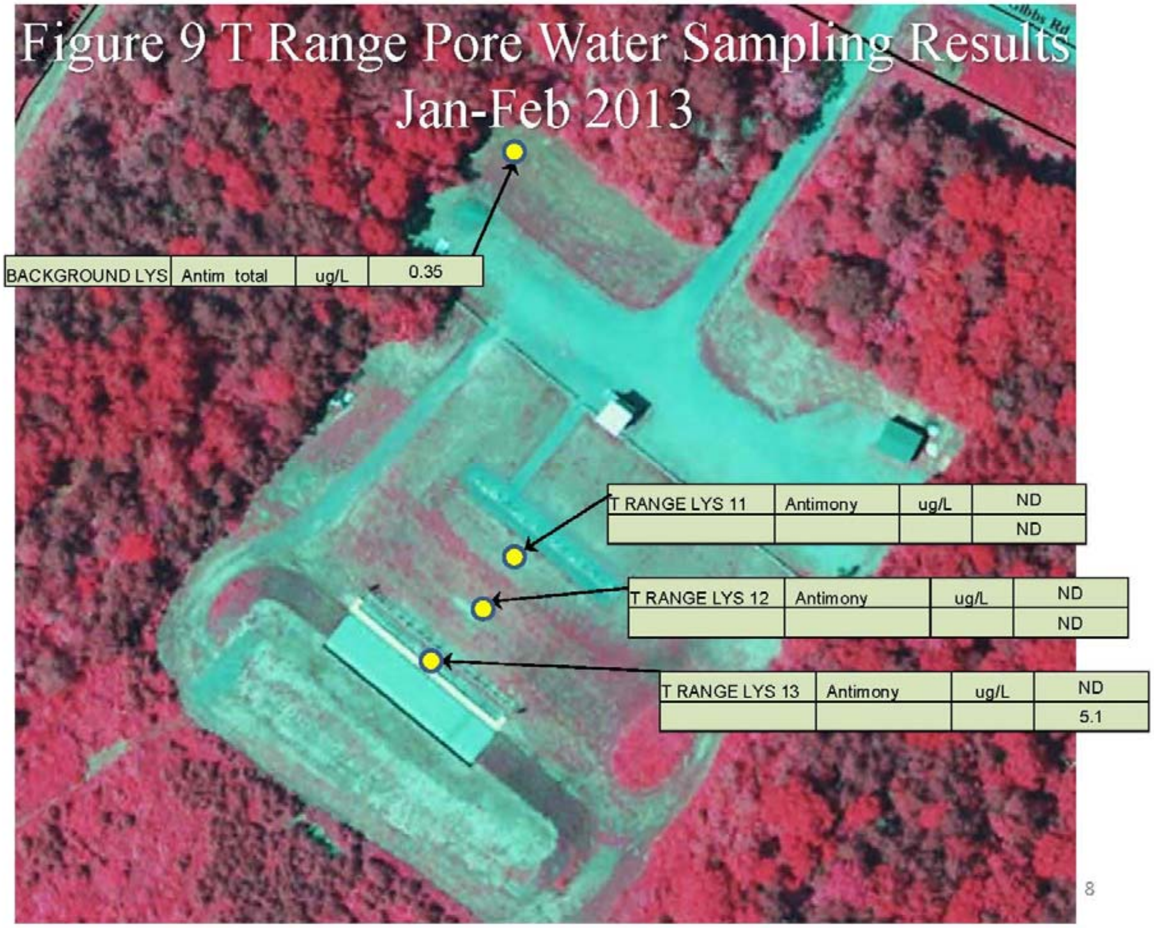


Figure 9 T Range Pore Water Sampling Results Jan-Feb 2013

Figure 10
OMMP Action Levels

Table 11-1. Surface Soil Action Levels

Analyte	
Lead	3,000 mg/Kg
Antimony	300 mg/Kg
Copper	10,000 mg/Kg

mg/kg= milligrams per kilograms or ppm

Table 11-2. Pore Water Action Levels

Analyte	
Lead	15 ug/L
Antimony	6 ug/L
Copper	1300 ug/L

ug/L= micrograms per liter or ppb

Table 11-3. Groundwater Action Levels

Analyte	
Lead	7.5 ug/L
Antimony	3 ug/L
Copper	650 ug/L

ug/L= micrograms per liter or ppb

TABLES

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TABLE 1
Small Arms Ranges Soil Sample Results
2013 Sampling Event

Site	Location ID	Field Sample ID	Top Depth	Bottom Depth	Date Sampled	Test Method	Analyte	Result Value	Qualifier	Units	MDL	RL
K Range	SSKRNG001	SSKRNG001_AUG13A	0	0.25	08/01/2013 11:00	6010C	Antimony	3.0	U	mg/Kg	0.24	3.0
K Range	SSKRNG001	SSKRNG001_AUG13A	0	0.25	08/01/2013 11:00	6010C	Copper	26.9		mg/Kg	0.11	1.2
K Range	SSKRNG001	SSKRNG001_AUG13A	0	0.25	08/01/2013 11:00	6010C	Lead	16.3		mg/Kg	0.22	0.50
K Range	SSKRNG001	SSKRNG001_AUG13B	0	0.25	08/01/2013 12:10	6010C	Antimony	3.0	U	mg/Kg	0.24	3.0
K Range	SSKRNG001	SSKRNG001_AUG13B	0	0.25	08/01/2013 12:10	6010C	Copper	21.2		mg/Kg	0.11	1.2
K Range	SSKRNG001	SSKRNG001_AUG13B	0	0.25	08/01/2013 12:10	6010C	Lead	13.7		mg/Kg	0.22	0.50
K Range	SSKRNG001	SSKRNG001_AUG13C	0	0.25	08/01/2013 13:30	6010C	Antimony	3.0	U	mg/Kg	0.24	3.0
K Range	SSKRNG001	SSKRNG001_AUG13C	0	0.25	08/01/2013 13:30	6010C	Copper	27.3		mg/Kg	0.11	1.2
K Range	SSKRNG001	SSKRNG001_AUG13C	0	0.25	08/01/2013 13:30	6010C	Lead	16.7		mg/Kg	0.22	0.50
K Range	SSKRNG002	SSKRNG002_JUL13A	0	0.25	07/31/2013 11:30	6010C	Antimony	3.0	U	mg/Kg	0.24	3.0
K Range	SSKRNG002	SSKRNG002_JUL13A	0	0.25	07/31/2013 11:30	6010C	Copper	7.6		mg/Kg	0.11	1.2
K Range	SSKRNG002	SSKRNG002_JUL13A	0	0.25	07/31/2013 11:30	6010C	Lead	22.3		mg/Kg	0.22	0.50
K Range	SSKRNG003	SSKRNG003_JUL13A	0	0.25	07/31/2013 12:30	6010C	Antimony	0.32	J	mg/Kg	0.24	3.0
K Range	SSKRNG003	SSKRNG003_JUL13A	0	0.25	07/31/2013 12:30	6010C	Copper	6.1		mg/Kg	0.11	1.2
K Range	SSKRNG003	SSKRNG003_JUL13A	0	0.25	07/31/2013 12:30	6010C	Lead	28.1		mg/Kg	0.22	0.50
K Range	SSKRNG004	SSKRNG004_JUL13A	0	0.25	07/31/2013 14:30	6010C	Antimony	3.0	U	mg/Kg	0.24	3.0
K Range	SSKRNG004	SSKRNG004_JUL13A	0	0.25	07/31/2013 14:30	6010C	Copper	7.9		mg/Kg	0.11	1.2
K Range	SSKRNG004	SSKRNG004_JUL13A	0	0.25	07/31/2013 14:30	6010C	Lead	24.9		mg/Kg	0.22	0.49
K Range	SSKRNG005	SSKRNG005_JUL13A	0	0.25	07/31/2013 15:30	6010C	Antimony	3.0	U	mg/Kg	0.24	3.0
K Range	SSKRNG005	SSKRNG005_JUL13A	0	0.25	07/31/2013 15:30	6010C	Copper	6.7		mg/Kg	0.11	1.2
K Range	SSKRNG005	SSKRNG005_JUL13A	0	0.25	07/31/2013 15:30	6010C	Lead	25.4		mg/Kg	0.22	0.50
K Range	SSKRNG006	SSKRNG006_JUL13A	0	0.25	08/16/2013 21:47	6010C	Antimony	3.0	U	mg/Kg	0.24	3.0
K Range	SSKRNG006	SSKRNG006_JUL13A	0	0.25	08/16/2013 21:47	6010C	Copper	7.8	B	mg/Kg	0.11	1.2
K Range	SSKRNG006	SSKRNG006_JUL13A	0	0.25	08/16/2013 21:47	6010C	Lead	22.0		mg/Kg	0.22	0.50
T Range	SSTRNG001	SSTRNG001_AUG13A	0	0.25	08/05/2013 13:50	6010C	Antimony	3.0	U	mg/Kg	0.25	3.0
T Range	SSTRNG001	SSTRNG001_AUG13A	0	0.25	08/05/2013 13:50	6010C	Copper	12.5	B	mg/Kg	0.11	1.3
T Range	SSTRNG001	SSTRNG001_AUG13A	0	0.25	08/05/2013 13:50	6010C	Lead	15.0		mg/Kg	0.22	0.50
T Range	SSTRNG001	SSTRNG001_AUG13B	0	0.25	08/06/2013 10:20	6010C	Antimony	3.0	U	mg/Kg	0.25	3.0
T Range	SSTRNG001	SSTRNG001_AUG13B	0	0.25	08/06/2013 10:20	6010C	Copper	10.8	B	mg/Kg	0.11	1.3
T Range	SSTRNG001	SSTRNG001_AUG13B	0	0.25	08/06/2013 10:20	6010C	Lead	15.0		mg/Kg	0.22	0.50
T Range	SSTRNG001	SSTRNG001_AUG13C	0	0.25	08/06/2013 11:00	6010C	Antimony	3.0	U	mg/Kg	0.24	3.0
T Range	SSTRNG001	SSTRNG001_AUG13C	0	0.25	08/06/2013 11:00	6010C	Copper	12.2	B	mg/Kg	0.11	1.2
T Range	SSTRNG001	SSTRNG001_AUG13C	0	0.25	08/06/2013 11:00	6010C	Lead	16.0		mg/Kg	0.22	0.49
T Range	SSTRNG002	SSTRNG002_AUG13A	0	0.25	08/05/2013 11:00	6010C	Antimony	3.0	U	mg/Kg	0.24	3.0
T Range	SSTRNG002	SSTRNG002_AUG13A	0	0.25	08/05/2013 11:00	6010C	Copper	9.8	B	mg/Kg	0.11	1.2
T Range	SSTRNG002	SSTRNG002_AUG13A	0	0.25	08/05/2013 11:00	6010C	Lead	15.0		mg/Kg	0.22	0.50

B= Analyte detected in laboratory prepared blank
ND/U = Non detect
J = Estimated Result
mg/kg = milligram/kilogram

MDL = Method Detectin Limit
RL = Reporting Limit
N = Native Sample
FR = Field Replicate Sample

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TABLE 1
Small Arms Ranges Soil Sample Results
2013 Sampling Event

T Range	SSTRNG003	SSTRNG003_AUG13A	0	0.25	08/05/2013 11:30	6010C	Antimony	0.55	J	mg/Kg	0.24	3.0
T Range	SSTRNG003	SSTRNG003_AUG13A	0	0.25	08/05/2013 11:30	6010C	Copper	111	B	mg/Kg	0.11	1.2
T Range	SSTRNG003	SSTRNG003_AUG13A	0	0.25	08/05/2013 11:30	6010C	Lead	225		mg/Kg	0.22	0.50
T Range	SSTRNG004	SSTRNG004_AUG13A	0	0.25	08/05/2013 12:10	6010C	Antimony	1.3	J	mg/Kg	0.24	3.0
T Range	SSTRNG004	SSTRNG004_AUG13A	0	0.25	08/05/2013 12:10	6010C	Copper	351	B	mg/Kg	0.11	1.2
T Range	SSTRNG004	SSTRNG004_AUG13A	0	0.25	08/05/2013 12:10	6010C	Lead	215		mg/Kg	0.22	0.49
T Range	SSTRNG005	SSTRNG005_AUG13A	0	0.25	08/05/2013 12:50	6010C	Antimony	3.0	U	mg/Kg	0.24	3.0
T Range	SSTRNG005	SSTRNG005_AUG13A	0	0.25	08/05/2013 12:50	6010C	Copper	44.1	B	mg/Kg	0.11	1.2
T Range	SSTRNG005	SSTRNG005_AUG13A	0	0.25	08/05/2013 12:50	6010C	Lead	135		mg/Kg	0.22	0.50
T Range	SSTRNG006	SSTRNG006_AUG13A	0	0.25	08/05/2013 13:20	6010C	Antimony	0.40	J	mg/Kg	0.24	3.0
T Range	SSTRNG006	SSTRNG006_AUG13A	0	0.25	08/05/2013 13:20	6010C	Copper	10.1	B	mg/Kg	0.11	1.2
T Range	SSTRNG006	SSTRNG006_AUG13A	0	0.25	08/05/2013 13:20	6010C	Lead	24.1		mg/Kg	0.22	0.49

B= Analyte detected in laboratory prepared blank
ND/U = Non detect
J = Estimated Result
mg/kg = milligram/kilogram

MDL = Method Detectin Limit
RL = Reporting Limit
N = Native Sample
FR = Field Replicate Sample

TABLE 2
Small Arms Range Lysimeter Sample Results
July/August 2013 Sampling Event

Site/SLX List	Location ID	Field Sample ID	Date Sampled	Test Method	Analyte	Result Value	Qualifier	Units	MDL	RL
J RANGE	LYJRNG001	LYJRNG001_JUL13	08/08/2013 14:03	6020A	Antimony	1.0	J B	ug/L	0.07	4.0
J RANGE	LYJRNG001	LYJRNG001_JUL13	08/08/2013 14:03	6020A	Copper	3.4	J B	ug/L	0.23	20.0
J RANGE	LYJRNG001	LYJRNG001_JUL13	08/08/2013 14:03	6020A	Lead	0.80	J	ug/L	0.02	2.0
J RANGE	LYJRNG002	LYJRNG002_JUL13	08/08/2013 13:57	6020A	Antimony	0.84	J B	ug/L	0.07	4.0
J RANGE	LYJRNG002	LYJRNG002_JUL13	08/08/2013 13:57	6020A	Copper	2.4	J B	ug/L	0.23	20.0
J RANGE	LYJRNG002	LYJRNG002_JUL13	08/08/2013 13:57	6020A	Lead	0.39	J	ug/L	0.02	2.0
J RANGE	LYJRNG003	LYJRNG003_JUL13	08/08/2013 13:51	6020A	Antimony	36.0	B	ug/L	0.07	4.0
J RANGE	LYJRNG003	LYJRNG003_JUL13	08/08/2013 13:51	6020A	Copper	1.8	J B	ug/L	0.23	20.0
J RANGE	LYJRNG003	LYJRNG003_JUL13	08/08/2013 13:51	6020A	Lead	0.22	J	ug/L	0.02	2.0
K RANGE	LYKRNG001	LYKRNG001_JUL13	08/08/2013 14:33	6020A	Antimony	0.10	J B	ug/L	0.07	4.0
K RANGE	LYKRNG001	LYKRNG001_JUL13	08/08/2013 14:33	6020A	Copper	0.90	J B	ug/L	0.23	20.0
K RANGE	LYKRNG001	LYKRNG001_JUL13	08/08/2013 14:33	6020A	Lead	2.0	U	ug/L	0.02	2.0
K RANGE	LYKRNG002	LYKRNG002_JUL13	08/08/2013 14:41	6020A	Antimony	0.086	J B	ug/L	0.07	4.0
K RANGE	LYKRNG002	LYKRNG002_JUL13	08/08/2013 14:41	6020A	Copper	1.3	J B	ug/L	0.23	20.0
K RANGE	LYKRNG002	LYKRNG002_JUL13	08/08/2013 14:41	6020A	Lead	0.16	J	ug/L	0.02	2.0
K RANGE	LYKRNG003	LYKRNG003_JUL13	08/08/2013 15:08	6020A	Antimony	11.6	B	ug/L	0.07	4.0
K RANGE	LYKRNG003	LYKRNG003_JUL13	08/08/2013 15:08	6020A	Copper	0.89	J B	ug/L	0.23	20.0
K RANGE	LYKRNG003	LYKRNG003_JUL13	08/08/2013 15:08	6020A	Lead	1.7	J	ug/L	0.02	2.0
K RANGE	LYKRNG004	LYKRNG004_JUL13	08/08/2013 13:13	6020A	Antimony	11.5	B	ug/L	0.07	4.0
K RANGE	LYKRNG004	LYKRNG004_JUL13	08/08/2013 13:13	6020A	Copper	6.4	J B	ug/L	0.23	20.0
K RANGE	LYKRNG004	LYKRNG004_JUL13	08/08/2013 13:13	6020A	Lead	3.4		ug/L	0.02	2.0
T RANGE	LYTRNG011	LYTRNG011_JUL13	08/08/2013 15:35	6020A	Antimony	0.20	J B	ug/L	0.07	4.0
T RANGE	LYTRNG011	LYTRNG011_JUL13	08/08/2013 15:35	6020A	Copper	1.8	J B	ug/L	0.23	20.0
T RANGE	LYTRNG011	LYTRNG011_JUL13	08/08/2013 15:35	6020A	Lead	0.29	J	ug/L	0.02	2.0
T RANGE	LYTRNG012	LYTRNG012_JUL13	08/08/2013 15:40	6020A	Antimony	0.15	J B	ug/L	0.07	4.0
T RANGE	LYTRNG012	LYTRNG012_JUL13	08/08/2013 15:40	6020A	Copper	2.5	J B	ug/L	0.23	20.0
T RANGE	LYTRNG012	LYTRNG012_JUL13	08/08/2013 15:40	6020A	Lead	2.0	U	ug/L	0.02	2.0
T RANGE	LYTRNG012	LYTRNG012_JUL13	08/08/2013 15:56	6020A	Antimony	0.124	J	ug/L	0.07	4.0
T RANGE	LYTRNG012	LYTRNG012_JUL13	08/08/2013 15:56	6020A	Copper	1.17	J	ug/L	0.23	20.0
T RANGE	LYTRNG012	LYTRNG012_JUL13	08/08/2013 15:56	6020A	Lead	2.0	U	ug/L	0.02	2.0
T RANGE	LYTRNG013	LYTRNG-013_JUL13	08/01/2013 12:55	6020A	Antimony	4.3		ug/L	0.07	4.0
T RANGE	LYTRNG013	LYTRNG-013_JUL13	08/01/2013 12:55	6020A	Copper	1.3	J B	ug/L	0.23	20.0
T RANGE	LYTRNG013	LYTRNG-013_JUL13	08/01/2013 12:55	6020A	Lead	2.0	U	ug/L	0.02	2.0
T RANGE	LYTRNG013	LYTRNG-013_JUL13	08/01/2013 12:55	6020A	Antimony	4.28		ug/L	0.07	4.0
T RANGE	LYTRNG013	LYTRNG-013_JUL13	08/01/2013 12:55	6020A	Copper	2.74	J	ug/L	0.23	20.0
T RANGE	LYTRNG013	LYTRNG-013_JUL13	08/01/2013 12:55	6020A	Lead	2.0	U	ug/L	0.02	2.0
BACKGROUND	LYTBGD001	LYTBGD001_JUL13	08/08/2013 15:27	6020A	Antimony	0.074	J B	ug/L	0.07	4.0
BACKGROUND	LYTBGD001	LYTBGD001_JUL13	08/08/2013 15:27	6020A	Copper	1.1	J B	ug/L	0.23	20.0
BACKGROUND	LYTBGD001	LYTBGD001_JUL13	08/08/2013 15:27	6020A	Lead	0.13	J	ug/L	0.02	2.0

B= Blank Contamination
J = Estimated Result
ND/U = Non detect

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ug/l = microgram/liter
MDL = Method Detectin Limit
RL = Reporting Limit

Table 3
Pore Water Sampling Results
January-February 2013

Site/SLX List	Location ID	Field Sample ID	Date Sampled	Test Method	Analyte	Result Value	Qualifier	Units	MDL	RL	Lab Name
J RANGE	LYJRNG001	LYJRNG001	02/05/2013	6020A	Antimony	0.71	JB	ug/L	0.073	4.0	TAL
J RANGE	LYJRNG001	LYJRNG001	02/05/2013	6020A	Antimony	ND		ug/L		5.0	Con-Test
J RANGE	LYJRNG002	LYJRNG002	02/05/2013	6020A	Antimony	1.0	JB	ug/L	0.073	4.0	TAL
J RANGE	LYJRNG002	LYJRNG002	02/05/2013	6020A	Antimony	ND		ug/L		5.0	Con-Test
J RANGE	LYJRNG003	LYJRNG003	02/05/2013	6020A	Antimony	40.5		ug/L	0.073	4.0	TAL
J RANGE	LYJRNG003	LYJRNG003	02/05/2013	6020A	Antimony	43		ug/L		5.0	Con-Test
J RANGE	LYJRNG003	LYJRNG003	02/05/2013	6020A	Phosphorus	66.5	JB	ug/L	4.0	250	TAL
K RANGE	LYKRNG001	LYKRNG001	02/05/2013	6020A	Antimony	0.085	JB	ug/L	0.073	20	TAL
K RANGE	LYKRNG001	LYKRNG001	02/05/2013	6020A	Antimony	ND				5	Con-Test
K RANGE	LYKRNG002	LYKRNG002	02/05/2013	6020A	Antimony	0.083	JB	ug/L	0.073	20	TAL
K RANGE	LYKRNG002	LYKRNG002	02/05/2013	6020A	Antimony	ND		ug/L		5	Con-Test
K RANGE	LYKRNG003	LYKRNG003	02/05/2013	6020A	Antimony	5.9		ug/L	0.073	20	TAL
K RANGE	LYKRNG003	LYKRNG003	02/05/2014	6020A	Antimony	12		ug/L		5	Con-Test
K RANGE	LYKRNG003	LYKRNG003	02/05/2013	6020A	Phosphorus	47.5	JB	ug/L	4.0	250	TAL
K RANGE	LYKRNG004	LYKRNG004	02/05/2013	6020A	Antimony	DRY		ug/L			TAL
K RANGE	LYKRNG004	LYKRNG004	02/05/2013	6020A	Antimony	15		ug/L		5	Con-Test
T RANGE	LYTRNG011	LYTRNG011	02/06/2013	6020A	Antimony	0.23	JB	ug/L	0.073	20	TAL
T RANGE	LYTRNG011	LYTRNG011	02/06/2013	6020A	Antimony	ND		ug/L		5	Con-Test
T RANGE	LYTRNG012	LYTRNG012	02/06/2013	6020A	Antimony	0.12	JB	ug/L	0.073	20	TAL
T RANGE	LYTRNG012	LYTRNG012	02/06/2013	6020A	Antimony	ND		ug/L		5	Con-Test
T RANGE	LYTRNG013	LYTRNG013	02/06/2013	6020A	Antimony	5.1	JB	ug/L	0.073	20	TAL
T RANGE	LYTRNG013	LYTRNG013 (dupe)	02/06/2013	6020A	Antimony	5.06	J	ug/L	0.073	20	TAL
T RANGE	LYTRNG013	LYTRNG013	02/06/2013	6020A	Antimony	ND		ug/L		5	Con-Test
BACKGROUND	LYTRBGD01	LYTRNGBG1_JAN13F	01/10/2013	6020A	Antimony	0.11	J	ug/L	0.073	20	TAL
BACKGROUND	LYTRBGD01	LYTRNGBG1_JAN13F	01/10/2013	6020A	Copper	1.2	J	ug/L	0.23	20	TAL
BACKGROUND	LYTRBGD01	LYTRNGBG1_JAN13F	01/10/2013	6020A	Lead	0.11	J	ug/L	0.024	2	TAL

B= Blank Contamination
J = Estimated Result
ND/U = Non detect

ug/l = microgram/liter
MDL = Method Detectin Limit
RL = Reporting Limit

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TABLE 4
Small Arms Range Groundwater Sample Results
2011 to 2013

Site/SLX List	Location ID	Top Depth (ft bgs)	Bottom Depth (ft bgs)	Test Method	Analyte	2011 Result Value	2012 Result Value	2013 Result Value	2013 Qualifier	Units	MDL	RL
J RANGE	MW-471S	84.59	94.59	SW6020A	Antimony	ND	ND	0.19	J B	UG/L	0.073	4.0
J RANGE	MW-471S	84.59	94.59	SW6020A	Copper	3.3	0.30	2.7	J B	UG/L	0.23	20.0
J RANGE	MW-471S	84.59	94.59	SW6020A	Lead	ND	ND	1.6	J	UG/L	0.024	2.0
J RANGE	MW-472S	85.31	95.31	SW6020A	Antimony	ND	ND	ND	U	UG/L	0.073	4.0
J RANGE	MW-472S	85.31	95.31	SW6020A	Copper	1	1.4	0.73	J B	UG/L	0.23	20.0
J RANGE	MW-472S	85.31	95.31	SW6020A	Lead	ND	ND	ND	U	UG/L	0.024	2.0
K RANGE	MW-473S	83.38	93.38	SW6020A	Antimony	ND	ND	0.19	J B	UG/L	0.073	4.0
K RANGE	MW-473S	83.38	93.38	SW6020A	Copper	0.31	1.2	3.4	J B	UG/L	0.23	20.0
K RANGE	MW-473S	83.38	93.38	SW6020A	Lead	ND	0.18	ND	U	UG/L	0.024	2.0
K RANGE	MW-474S	86.44	96.44	SW6020A	Antimony	ND	ND	0.48	J B	UG/L	0.073	4.0
K RANGE	MW-474S	86.44	96.44	SW6020A	Copper	ND	0.82	3.6	J B	UG/L	0.23	20.0
K RANGE	MW-474S	86.44	96.44	SW6020A	Lead	ND	0.042	0.78	J	UG/L	0.024	2.0
T RANGE	MW-467S	124.94	134.94	SW6020A	Antimony	ND	ND	0.14	J	UG/L	0.073	4.0
T RANGE	MW-467S	124.94	134.94	SW6020A	Copper	ND	0.26	15.7	J B	UG/L	0.23	20.0
T RANGE	MW-467S	124.94	134.94	SW6020A	Lead	ND	0.097	3.1		UG/L	0.024	2.0

Note - Well MW-489S was also sampled under the OMMP until 2011.

B= Blank contamination
ND/U = Non Detect
J = Estimated result

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ug/L = microgram/liter
MDL = Method Detection Limit
RL = Reporting LImit

TABLE 5
Small Arms Range Surface Water Sample Results
February 2013

Site/SLX List	Location ID	Field Sample ID	Date Sampled	Test Method	Analyte	Result Value	Qualifier	Units	MDL	RL
J RANGE	J RANGE LEFT SWALE	J RANGE SW LEFT	01/31/2013	6020A	Antimony	0.76	J B	ug/L	0.073	20.0
K RANGE	K RANGE LEFT SWALE	K RANGE SW LEFT	01/31/2013	6020A	Antimony	2.1	J B	ug/L	0.073	20.0
K RANGE	K RANGE RIGHT SWALE	K RANGE SW RIGHT	01/31/2013	6020A	Antimony	13.2	J B	ug/L	0.073	20.0

B= Blank Contamination
J = Estimated Result
ND/U = Non detect

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ug/l = microgram/liter
MDL = Method Detectin Limit
RL = Reporting Limit

ATTACHMENT 1

Camp Edwards Range Control STAPP

Range Maintenance/ pH Testing / Lime Spread Form (Appendix C)

(This form is to be completed by Camp Edwards Range Control personnel when range maintenance is conducted and on a monthly basis or as needed for PH testing. Once completed file in appropriate range binder for submission.)

A. Administrative Information

Name: 1SG Earle F. Eldridge/Mr. Paul Nixon | **Date: 17 April 2013**

Range (circle one): Juliet / Kilo / Tango

B. PH Testing Results

Sample Number	1 Ln 1	2 Ln 4	3 Ln 7	4 L 10	5 L 13	6 L 15	7	8	9	10	11	12
Firing Line	6.6	6.8	7.3	7.0	6.6	7.0						
Berm	7.5	7.6	7.8	7.7	7.7	7.7						
STAPP												

**Take a total of 6-12 samples along the entire firing line, 6-12 samples along the berm and 6-12 samples along front of STAPP System.

**Required PH Level by OMMP: 6.5 - 8.5

C Lime Spread/Type of Lime

**Lime will be applied before peak training season to increase its effectiveness/ applied as need after annual pH check.

Date	Type of Lime	How Spread/ Rate
Firing Line pH Totals: 41.3	Divided by 6 Samples Taken: 6.9	Avg.: 6.9 High: 7.3 Low: 6.6
Berm pH Totals: 46.0	Divided by 6 Samples Taken: 7.7	Avg.: 7.7 High: 7.8 Low: 7.5
**pH Tester Drifted +.2 **		

D. Signature

Signature of Soldier Conducting PH Testing: Earle F. Eldridge Jr 1SG

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Camp Edwards Range Control STAPP
Range Maintenance/ pH Testing / Lime Spread Form (Appendix C)

(This form is to be completed by Camp Edwards Range Control personnel when range maintenance is conducted and on a monthly basis or as needed for PH testing. Once completed file in appropriate range binder for submission.)

A. Administrative Information

Name: 1SG Earle F. Eldridge/Mr. Paul Nixon **Date:** 17 April 2013

Range (circle one): Juliet / Kilo / Tango

B. PH Testing Results

Sample Number	1 Ln 3	2 Ln 6	3 Ln 9	4 L 12	5 L 15	6 L 17	7	8	9	10	11	12
Firing Line	7.4	7.7	7.7	7.5	7.4	7.8						
Berm	7.6	7.2	6.7	7.4	7.5	6.7						
STAPP												

**Take a total of 6-12 samples along the entire firing line, 6-12 samples along the berm and 6-12 samples along front of STAPP System.

**Required PH Level by OMMP: 6.5 - 8.5

C Lime Spread/Type of Lime

**Lime will be applied before peak training season to increase its effectiveness/ applied as need after annual pH check.

Date	Type of Lime	How Spread/ Rate
Firing Line pH Totals: 45.5	Divided by 6 Samples Taken: 7.6	Avg.: 7.6 High: 7.8 Low: 7.4
Berm pH Totals: 43.1	Divided by 6 Samples Taken: 7.2	Avg.: 7.2 High: 7.6 Low: 6.7
**pH Tester Drifted +.5 **		

D. Signature

Signature of Soldier Conducting PH Testing: Earle F. Eldridge 1SG

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Camp Edwards Range Control STAPP
Range Maintenance/ pH Testing / Lime Spread Form (Appendix C)

(This form is to be completed by Camp Edwards Range Control personnel when range maintenance is conducted and on a monthly basis or as needed for PH testing. Once completed file in appropriate range binder for submission.)

A. Administrative Information

Name: 1SG Earle F. Eldridge/Mr. Paul Nixon | **Date: 17 April 2013**

Range (circle one): Juliet / Kilo / Tango

B. PH Testing Results

Sample Number	1 Ln 2	2 Ln 7	3 L 12	4 L 17	5 L 22	6 L 27	7	8	9	10	11	12
Firing Line	6.9	7.2	7.0	7.0	6.7	6.9						
Berm	6.3	6.5	6.6	6.9	7.1	7.0						
STAPP												

**Take a total of 6-12 samples along the entire firing line, 6-12 samples along the berm and 6-12 samples along front of STAPP System.

**Required PH Level by OMMP: 6.5 - 8.5

C Lime Spread/Type of Lime

**Lime will be applied before peak training season to increase its effectiveness/ applied as need after annual pH check.

Date	Type of Lime	How Spread/ Rate
Firing Line pH Totals: 41.7	Divided by 6 Samples Taken: 7.0	Avg.: 7.0 High: 7.2 Low: 6.7
Berm pH Totals: 40.4	Divided by 6 Samples Taken: 6.7	Avg.: 6.7 High: 7.1 Low: 6.3

D. Signature

Signature of Soldier Conducting PH Testing: Earle F. Eldridge 1SG

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Camp Edwards Range Control

Range Maintenance/ pH Testing / Lime Spread Form (Appendix C)

(This form is to be completed by Camp Edwards Range Control personnel when range maintenance is conducted and on a monthly basis or as needed for PH testing. Once completed file in appropriate range binder for submission.)

A. Administrative Information

Name: miss Paga	**Signature:** [illegible]	**Date:** 10/18/13
Range : INDIA		

B. Lead Range - PH Testing Results

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12
Firing Line												
Berm												
STAPP												

**Take a total of 6-12 samples along the entire firing line, 6-12 samples along the berm and 6-12 samples along front of STAPP System. ***Required PH Level by OMMP: 6.5 - 8.5

C. Copper Ranges - PH Testing Results

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12
Firing Line	5.5	5.4	5.7	6.3	5.9	6.2						
(3) Bullet Pockets ~~In 320M Berm~~	6.2	6.4	6.5									
(3)Random Backstop berms												
Lysimeters												

**Take a total of 6 samples along the entire firing line. ***Required PH Level by OMMP: 6 - 8.5

D. Other Ranges - PH Testing Results

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12
Firing Line												
Target location												
Other:												

E. Lime Spread/Type of Lime

**Lime will be applied before peak training season to increase its effectiveness/ applied as need after annual pH check.

Date	Type of Lime	How Spread/ Rate

C-4

Camp Edwards Range Control
Range Maintenance/ pH Testing / Lime Spread Form (Appendix C)
(This form is to be completed by Camp Edwards Range Control personnel when range maintenance is conducted and on a monthly basis or as needed for PH testing. Once completed file in appropriate range binder for submission.)

A. Administrative Information		
Name: MISS PAGE	Signature: [illegible]	Date: 10/18/13
Range : JULIETTE		

B. Lead Range - PH Testing Results

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12
Firing Line	7.4	7.5	7.4	7.2	6.2	6.4						
Berm	7.2	7.3	7.4	7.1	7.1	7.1						
STAPP												

**Take a total of 6-12 samples along the entire firing line, 6-12 samples along the berm and 6-12 samples along front of STAPP System. ***Required PH Level by OMMP: 6.5 - 8.5

C. Copper Ranges - PH Testing Results

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12
Firing Line												
(3) Bullet Pockets In 320M Berm												
(3)Random Backstop berms												
Lysimeters												

**Take a total of 6 samples along the entire firing line. ***Required PH Level by OMMP: 6 - 8.5

D. Other Ranges - PH Testing Results

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12
Firing Line												
Target location												
Other:												

E. Lime Spread/Type of Lime

**Lime will be applied before peak training season to increase its effectiveness/ applied as need after annual pH check.

Date	Type of Lime	How Spread/ Rate

C-4

Camp Edwards Range Control

Range Maintenance/ pH Testing / Lime Spread Form (Appendix C)

(This form is to be completed by Camp Edwards Range Control personnel when range maintenance is conducted and on a monthly basis or as needed for PH testing. Once completed file in appropriate range binder for submission.)

Administrative Information

Name: miss PAGC	Signature: [illegible]	Date: 10/18/13
Range : Kilo		

B. Lead Range - PH Testing Results

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12
Firing Line	4.9	6.0	6.3	6.5	6.2	6.6						
Berm	7.0	7.2	7.1	7.1	7.4	6.9						
STAPP												

**Take a total of 6-12 samples along the entire firing line, 6-12 samples along the berm and 6-12 samples along front of STAPP System. ***Required PH Level by OMMP: 6.5 - 8.5

C. Copper Ranges - PH Testing Results

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12
Firing Line												
Bullet Pockets In 320M Berm												
(3)Random Backstop berms												
Lysimeters												

**Take a total of 6 samples along the entire firing line. ***Required PH Level by OMMP: 6 - 8.5

D. Other Ranges - PH Testing Results

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12
Firing Line												
Target location												
Other:												

E. Lime Spread/Type of Lime

**Lime will be applied before peak training season to increase its effectiveness/ applied as need after annual pH check.

Date	Type of Lime	How Spread/ Rate

C-4

Camp Edwards Range Control
Range Maintenance/ pH Testing / Lime Spread Form (Appendix C)

(This form is to be completed by Camp Edwards Range Control personnel when range maintenance is conducted and on a monthly basis or as needed for PH testing. Once completed file in appropriate range binder for submission.)

Administrative Information

Name: MISS PAGE | Signature: [illegible] | Date: 10/18/13

Range : SIERRA

B. Lead Range - PH Testing Results

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12
Firing Line												
Berm												
STAPP												

**Take a total of 6-12 samples along the entire firing line, 6-12 samples along the berm and 6-12 samples along front of STAPP System. ***Required PH Level by OMMP: 6.5 - 8.5

C. Copper Ranges - PH Testing Results

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12
Firing Line	6.1	6.0	6.1	6.6	6.7	6.3						
LANE	7/8	6/7	5/6									
Bullet Pockets In 320M Berm	5.5	6.2	5.8									
	8R	7R	4R	ALL 50 M								
(3)Random Backstop berms	5.8	6.2	6.1									
Lysimeters												

**Take a total of 6 samples along the entire firing line. ***Required PH Level by OMMP: 6 - 8.5

D. Other Ranges - PH Testing Results

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12
Firing Line												
Target location												
Other:												

E. Lime Spread/Type of Lime

**Lime will be applied before peak training season to increase its effectiveness/ applied as need after annual pH check.

Date	Type of Lime	How Spread/ Rate

C-4

Camp Edwards Range Control

Range Maintenance/ pH Testing / Lime Spread Form (Appendix C)

(This form is to be completed by Camp Edwards Range Control personnel when range maintenance is conducted and on a monthly basis or as needed for PH testing. Once completed file in appropriate range binder for submission.)

Administrative Information

Name: Miss PAGE	Signature: [illegible]	Date: 10/18/13
Range: TANGO		

B. Lead Range - PH Testing Results

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12
Firing Line	6.5	7.5	7.1	7.4	7.5	7.3						
~~Berm~~ TARGET	7.9	7.7	7.7	7.7	7.7	7.8						
STAPP												

**Take a total of 6-12 samples along the entire firing line, 6-12 samples along the berm and 6-12 samples along front of STAPP System. ***Required PH Level by OMMP: 6.5 - 8.5

C. Copper Ranges - PH Testing Results

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12
Firing Line												
, Bullet Pockets In 320M Berm												
(3)Random Backstop berms												
Lysimeters												

**Take a total of 6 samples along the entire firing line. ***Required PH Level by OMMP: 6 - 8.5

D. Other Ranges - PH Testing Results

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12
Firing Line												
Target location												
Other:												

E. Lime Spread/Type of Lime

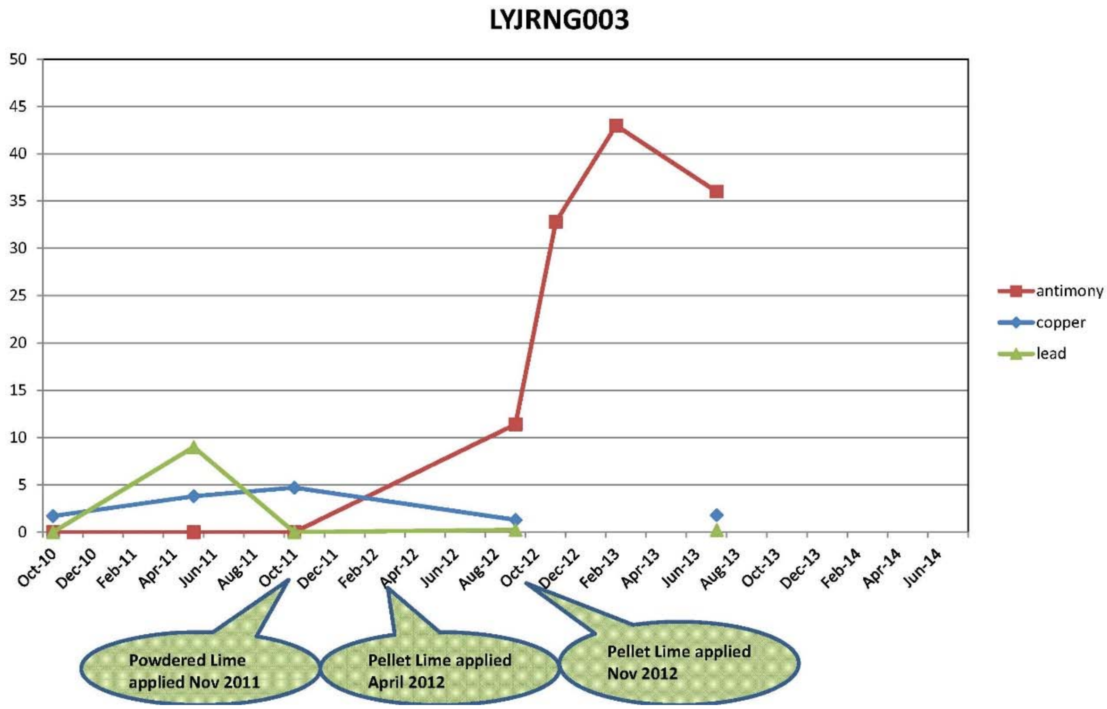
**Lime will be applied before peak training season to increase its effectiveness/ applied as need after annual pH check.

Date	Type of Lime	How Spread/ Rate

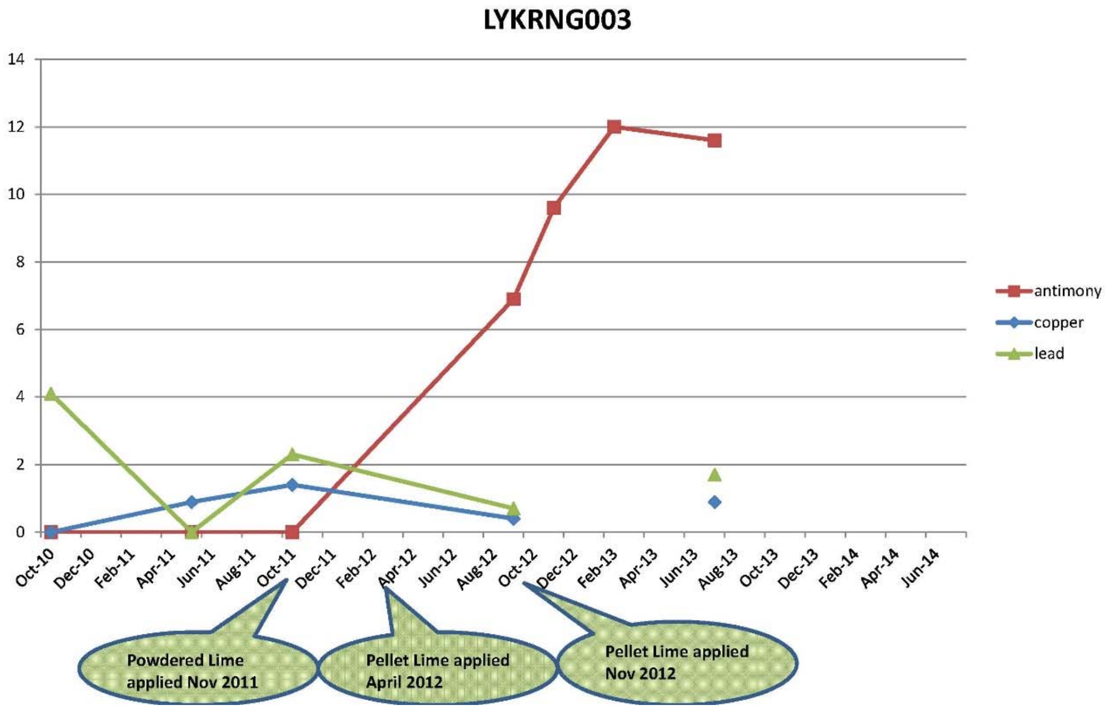
C-4

ATTACHMENT 2

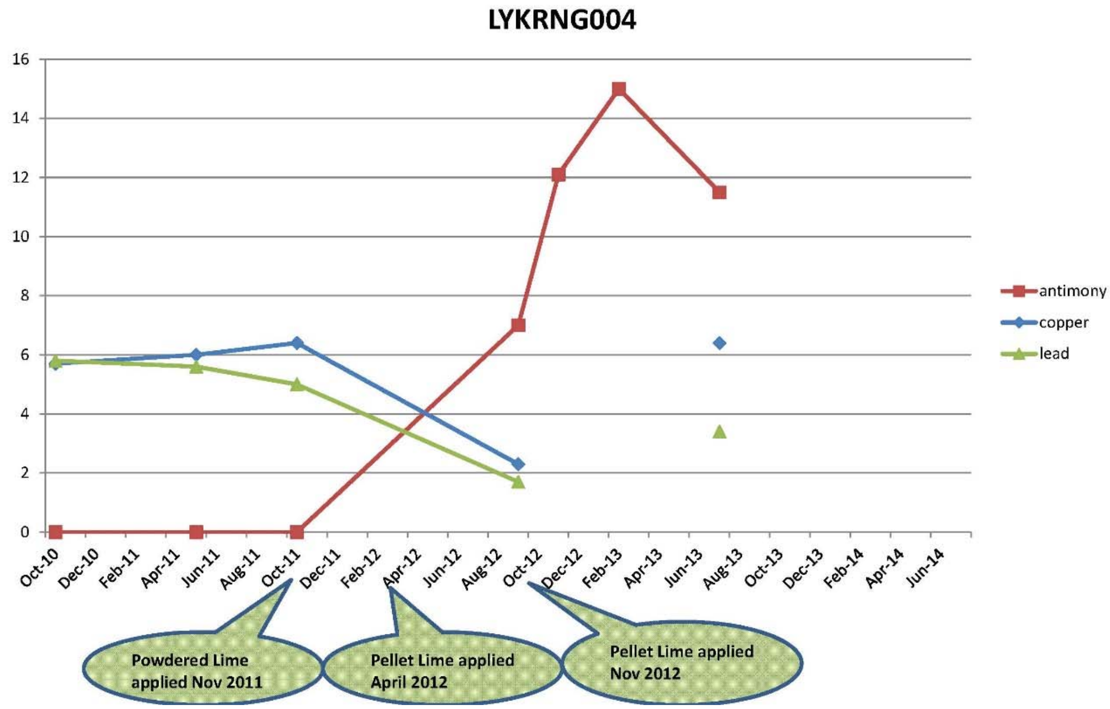
Metals in J Range Lysimeter #3



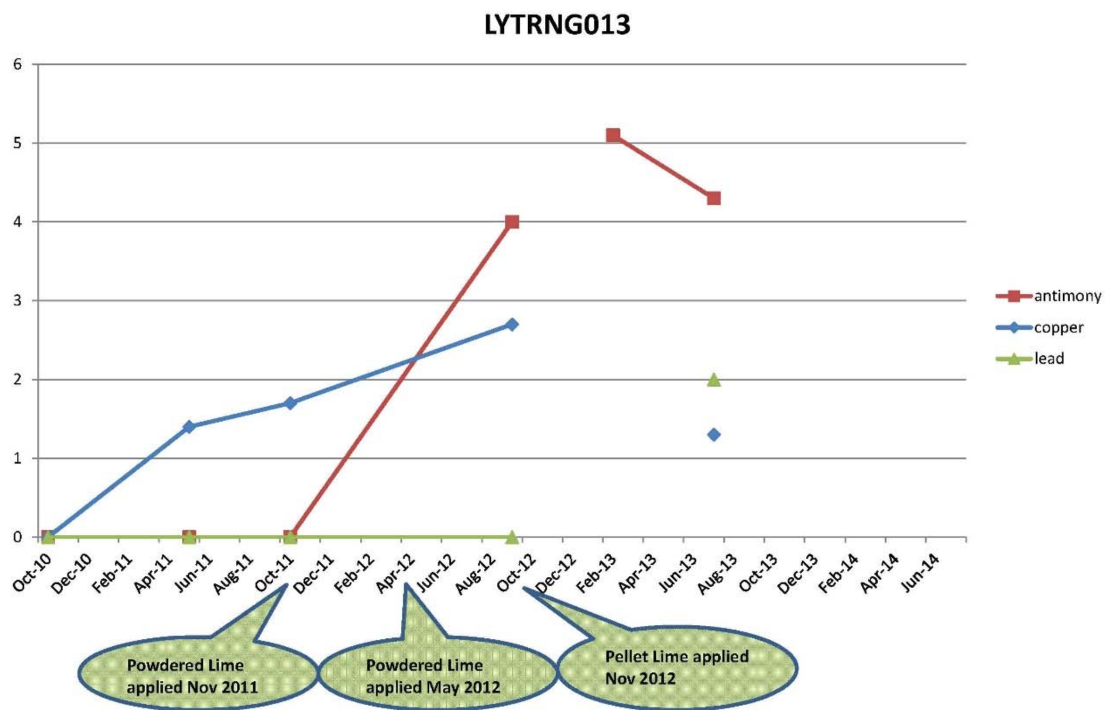
Metals in K Range Lysimeter #3



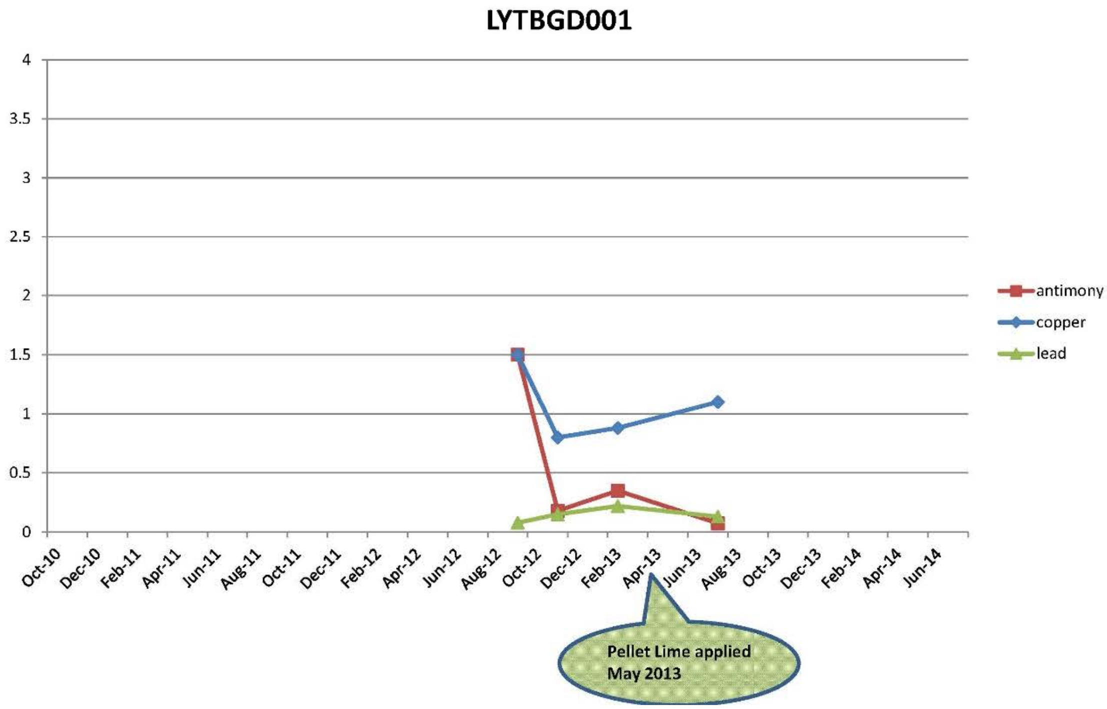
Metals in K Range Lysimeter #4



Metals in T Range Lysimeter #13



Metals in Background Lysimeter



JULIET, KILO, AND TANGO RANGES 2014 ENVIRONMENTAL SAMPLING AND ANALYSIS REPORT

1.0 INTRODUCTION

Juliet, Kilo, and Tango Ranges at Camp Edwards are 25-meter small arms ranges (SARs) currently used for marksmanship training using lead ammunition under a pilot project approved by the US Environmental Protection Agency (EPA). This pilot period has been extended until December 31, 2015. The Environmental Management Commission's (EMC) pilot period ended in 2014. The pilot periods were intended to assess the STAPP bullet containment systems installed on these three ranges and to determine if the ranges can be used for live firing with lead ammunition while protecting groundwater. Figure 1 shows the locations of J, K, and T Ranges within Camp Edwards.

In accordance with the conditions established by the EMC and the EPA for the Massachusetts Army National Guard (MAARNG) to fire lead ammunition, these ranges are operated and maintained as outlined in the Best Management Practices and Operation, Maintenance and Monitoring Plan (OMMP) for Juliet, Kilo, and Tango Ranges at Camp Edwards, Massachusetts which was approved in April 2014. That OMMP superseded the previous version.

The OMMP includes a program of periodic sampling of soil, pore water, and groundwater. The samples are analyzed for select metals such as lead, copper, and antimony that are commonly used in ammunition. Pore water samples are also field screened for pH which is an important parameter for determining the mobility of certain metals in the environment. The goal of this monitoring program is to determine when routine maintenance activities are needed to promote range sustainability and to protect groundwater.

This report summarizes the environmental monitoring that was conducted by the MAARNG in 2014 as prescribed in the current version of the OMMP.

2.0 RANGE USE SUMMARY

2.1 J Range

J Range has been used as a SAR since the 1980s. Investigations of soil and groundwater were completed by the Impact Area Groundwater Study Program (IAGWSP) and the Final Juliet (J) Range Soil and Groundwater Investigation Report was completed in September 2008. Levels of nitroglycerine and lead that indicated deposition from range use were detected in soil. However, these analytes were not detected in groundwater. The MAARNG decided to remove

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surface soils from the range and regrade it in 2008 and a STAPP bullet collection system was installed. The range floor was completely re-graded and reconstructed to improve drainage in 2010. Three pan lysimeters were installed on the range in 2010 to monitor pore water percolating through the soil. The pilot period commenced on J Range in 2009. Approximately 218,200 bullets have been fired into the STAPP system since 2009.

2.2 K Range

K Range has been used as a SAR since the 1980s. Investigations of soil and groundwater were completed by the IAGWSP and the Final Kilo (K) Range Soil and Groundwater Investigation Report was completed in September 2008. Levels of nitroglycerine and lead that indicated deposition from range use were detected in soil. However, these analytes were not detected in groundwater. The MAARNG regraded the range and installed a STAPP bullet collection system in 2008. The range floor was completely re-graded and reconstructed to improve drainage in 2010. Three pan lysimeters were installed on the range in 2010 to monitor pore water percolating through the soil. The pilot period commenced on K Range in 2009. Approximately 429,000 bullets have been fired into the STAPP System since 2009.

2.3 T Range

T Range has been used as a SAR since the 1980s. Investigations of soil and groundwater were completed by the IAGWSP and the Draft Final T Range Soil and Groundwater Investigation Report was completed by the IAGWSP in June 2007. Levels of nitroglycerine and lead were detected in soil that indicated deposition from range use. However, these analytes were not detected in groundwater.

The MAARNG re-graded surface soils from the mounded firing line, in effect raising the 25-meter firing line and improving the angle of fire into the STAPP system. The area between the firing line and the new berm were not excavated or regraded. The STAPP bullet collection system was installed in 2006. Several suction lysimeters were installed in 2007 to monitor pore water percolating through the soil for tungsten. These were removed after sampling in 2010 because of concerns with the quality and representativeness of the samples. Three pan lysimeters were installed on the range in 2010. The pilot period commenced in 2008. Operational samples were first collected under the OMMP in 2008. Approximately 316,000 bullets have been fired into the STAPP System since 2008.

3.0 MONITORING REQUIREMENTS AND RESULTS

3.1 Surface Soil

The soil sampling at J, K, and T Ranges includes multi-increment sampling (MIS) from 6 sample areas on each range on alternating years. The sample areas are laid out in strips across the width of the ranges from the firing lines to the backstop berms so that the impact of metals deposition at the firing lines, the target areas, and the areas in between could be separately quantified.

Soil samples were collected from J range in August 2014. K and T Ranges were sampled in 2013 and will be sampled again in 2015.

One hundred-point composite samples were collected from each sample area from a depth of 0 to 3 inches below ground surface (bgs). Two replicate 100-point samples were also collected from Area 1. All samples were submitted to Test America Laboratory, Inc. in Burlington, Vermont for analysis. All samples were ground and processed in accordance with Method 8330B. Soil samples were analyzed by method 6010C for antimony, copper, and lead. Soil sampling locations are shown on Figure 2 and analytical results are summarized in Table 1.

3.2 Pore Water Sampling

Pore water samples were collected from the pan lysimeters installed on J, K, and T Ranges in August 2014. All pan lysimeters are installed approximately 2 feet below the ground surface. All pore water samples were analyzed by method 6020A for antimony, copper, and lead. Samples were not filtered prior to analysis. The locations of the lysimeters are shown on Figures 3, 4, and 5. Analytical results are summarized in Table 2.

During pore water sampling, pH readings were taken from the pore water during sampling of the lysimeters. The pH readings ranged from 5.1 to 7.0 as summarized in Exhibit 1 below. The previous readings are also included in the table for comparison. The average pore water pH across the three ranges has dropped from 8.0 in 2011 to 6.1 at present.

EXHIBIT 1

LYSIMETER LOCATION	Oct 2011	Sept 2012	Nov 2012	February 2013	July-August 2013	August 2014
JRNG 001	8.6	6.7	NS	6.7	6.4	6.5
JRNG 002	7.6	6.5	NS	7.1	6.4	6.6
JRNG 003	8.0	6.6	8.7	7.2	6.5	6.6
KRNG 001	No H2O	6.4	NS	5.6	5.6	6.0
KRNG 002	7.6	5.7	NS	5.5	5.5	5.4
KRNG 003	9.0	6.4	5.7	7.4	6.3	7.0
KRNG 004	No H2O	6.3	6.7	6.8	6.3	5.7
TRNG 011	7.0	6.0	NS	6.3	5.7	5.8
TRNG 012	No H2O	5.6	NS	5.6	5.2	5.1
TRNG 013	8.1	6.3	NS	6.1	5.5	5.9
AVERAGES	8.0	6.3	7.0	6.4	5.9	6.1

NS= not sampled.

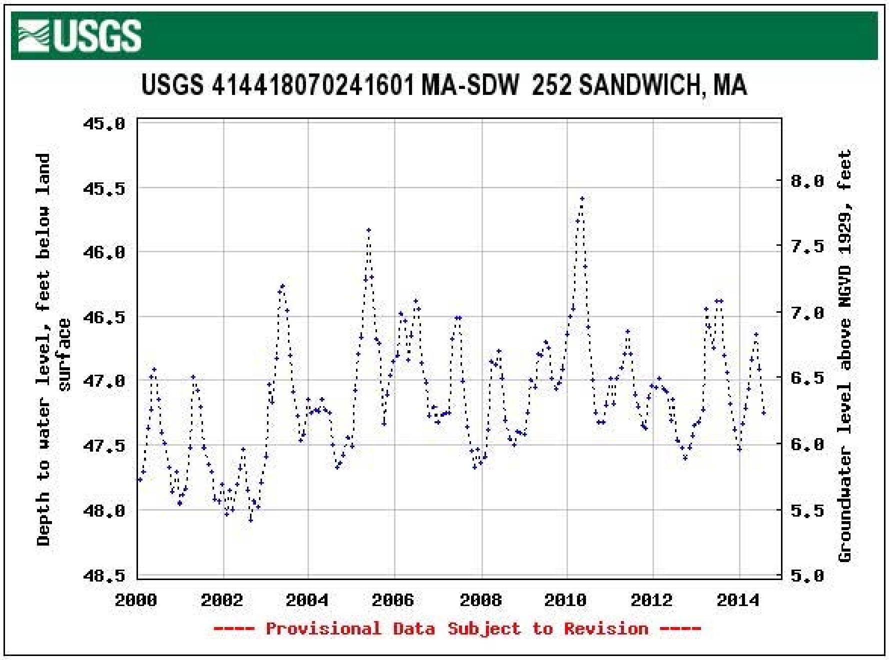
*= Value not included in calculation of Averages.

3.3 Groundwater

Groundwater monitoring well locations are shown on Figures 3, 4, and 5. Groundwater samples were collected from all four wells in the monitoring program (MW-471s, MW-472s, MW-474s, and MW-467s) in August 2014.

The water level in well MW-474S was below the level of the pump intake so a grab sample was collected with a bailer after temporarily removing the dedicated pump. Exhibit 2 below shows the trends in groundwater elevation at JBCC over the past 14 years. While the current elevations are not historically low, they do seem to be lower than when the wells were installed.

EXHIBIT 2



Only unfiltered (total metals) samples were collected during this sampling round. Samples were analyzed by method 6020A for antimony, copper, and lead. No significant concentrations of metals were detected in any of the wells. Results are summarized in Table 3.

4.0 COMPARISON TO OMMP ACTION LEVELS

The current version of the J, K, and T Ranges OMMP lists action levels for soil, pore water, and groundwater concentrations that trigger response actions. Action levels have been assigned for antimony, copper, and lead. The action levels are summarized on Figure 6.

4.1 Soil

No action levels were exceeded in soil samples collected at J Range in 2014. K and T Ranges were not sampled in 2014.

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4.2 Pore Water

The action level for antimony in pore water (6 ppb) was exceeded in lysimeter LYJRNG003 at J Range and lysimeters LYKRNG003 and LYKRNG004 at K Range. The action level for antimony in pore water was also exceeded in lysimeter LYTRNG0013 at T Range. All of these lysimeters are located near the berms and those on J and K range are related to drainage swales on these ranges.

Because the exceedences of the antimony action level for pore water were expected based on similar previous sampling results, re-sampling of these lysimeters was not conducted as per the OMMP.

4.3 Groundwater

No action levels were exceeded in the groundwater monitoring wells at J Range.

No action levels were exceeded in the groundwater monitoring wells at K Range.

No action levels were exceeded in the groundwater monitoring wells at T Range.

5.0 COMPARISON WITH PREVIOUS SAMPLING RESULTS

5.1 Soil

Soil sampling at J Range started in October 2010 after reconstruction of the range including replacement of the range floor. The 2014 average concentration is slightly higher than in previous rounds but still well below the action level. Average lead concentrations over time are summarized in Exhibit 3 below.

EXHIBIT 3

Average lead concentrations, ppm						
	Oct-10	May-11	Oct-11	Sept-12	July/Aug 2013	Aug 2014
J Range	44	53	50	34	Not Sampled	65
K Range	24	23	27	Not Sampled	23	Not Sampled
T Range	212	165	207	Not Sampled	105	Not Sampled

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5.2 Pore Water

The pore water lysimeters at J, K, and T Ranges have been sampled 7 times: October 2010, May 2011, October 2011, September 2012, February 2013, July/August 2013, and August 2014. In addition, samples were collected from the three lysimeters with antimony concentrations exceeding the action level (6 ppb) in November 2012. Method 6010 was used to analyze for metals during the first monitoring event, the more sensitive 6020A method has been used since May 2011. The typical minimum detection level (MDL) for antimony dropped from 3.6 ppb to 0.073 ppb with the change in analytical method.

Copper, lead, and antimony have all been detected in various lysimeters during pore water sampling events since the first pan lysimeter samples were collected in 2010. However, the detections are often not repeated in subsequent events. For example, in May 2011, the highest lead concentration in pore water to date was detected at 9 ppb in lysimeter LYJRNG003 on J Range. No lead was detected in this lysimeter in October 2011 and only low concentrations, barely above the detection limit, were detected in September 2012 and July/August 2013 and August 2014.

Antimony was detected at significant concentrations in lysimeters for the first time during the September 2012 monitoring. It has been consistently detected at concentrations above the action level in lysimeters in the drainage swales at J and K Ranges since that time. Charts showing the antimony, lead, and copper concentrations in pore water during OMMP sampling are included as Attachment 1. Note that the excel graphing function only recognizes numbers so results which were below the minimum detectable levels are reported as 0 ppb on the charts even though the analytical method is not capable of quantifying concentrations below the MDL.

The analysis of four rounds of background pore water sampling near T Range indicate antimony concentrations as high as 1.5 ppb, copper as high as 1.6 ppb, and lead as high as 0.22 ppb. Similar concentrations of these metals detected in lysimeters on the ranges may tentatively be expected to be background concentrations.

5.3 Groundwater

The groundwater wells at J, K, and T Ranges have been sampled 6 times under the OMMPs: October 2010, May 2011, October 2011, September 2012, and July/August 2013, and August 2014. Method 6010 was used to analyze for metals during the first monitoring event, the more sensitive 6020A method has been used since May 2011. Results of the groundwater analyses since 2011 are included in Table 4.

As with the pore water sampling, the reduced detection limits of method 6020A have lead to frequent detections of low concentrations of metals. These could be

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representative of background conditions but a study of background metals concentrations in groundwater near the SARs has not been attempted.

All antimony concentrations detected during this and previous sampling rounds have been below the reporting limit of the analysis. No trends are apparent in the antimony groundwater concentrations to date.

Concentrations of copper remain below levels of concern and no trends are apparent. The concentrations of copper, while always low, are more variable than those of the other metals. This may be indicative of sediment in the samples. Sediment has been suspected of causing elevated metals concentrations in the past.

Concentrations of lead remain low. The concentration in well MW471S at J Range has increased slightly and will be monitored to see if the trend continues. As of this sampling round, it is still well below the action level. The increased lead concentration mirrors an increase in copper indicating that sediment may have been present in the sample. This is the only lead result where the concentration was above the reporting limit of the analysis. While an increasing trend is apparent in the lead concentrations at this well, the cause is likely to be sediment given the concurrent detection of all three metals.

6.0 REPEATABILITY OF REPLICATE SOIL SAMPLES

Repeatability of a sampling program is assessed through the collection and analysis of replicate samples from the same sample area. The Relative Standard Deviation (RSD) of the replicates is calculated and compared to a quality goal. The RSD = the standard deviation of the three replicate results divided by the average of the three results expressed as a percentage. EPA has indicated a preference for RSDs of 25% or less for sampling at J, K, and T Ranges.

Replicate samples were collected from Area 1 at J Range during 2014. The RSD for lead at Area 1 J Range was 25% and for copper the RSD was 4% so the repeatability was acceptable. Concentrations of antimony were not detected in the three replicate samples from Area 1.

The RSDs discussed above are similar to previous results. It is apparent that the sampling protocol in use at the ranges provides consistent and repeatable results.

7.0 FURTHER ACTION

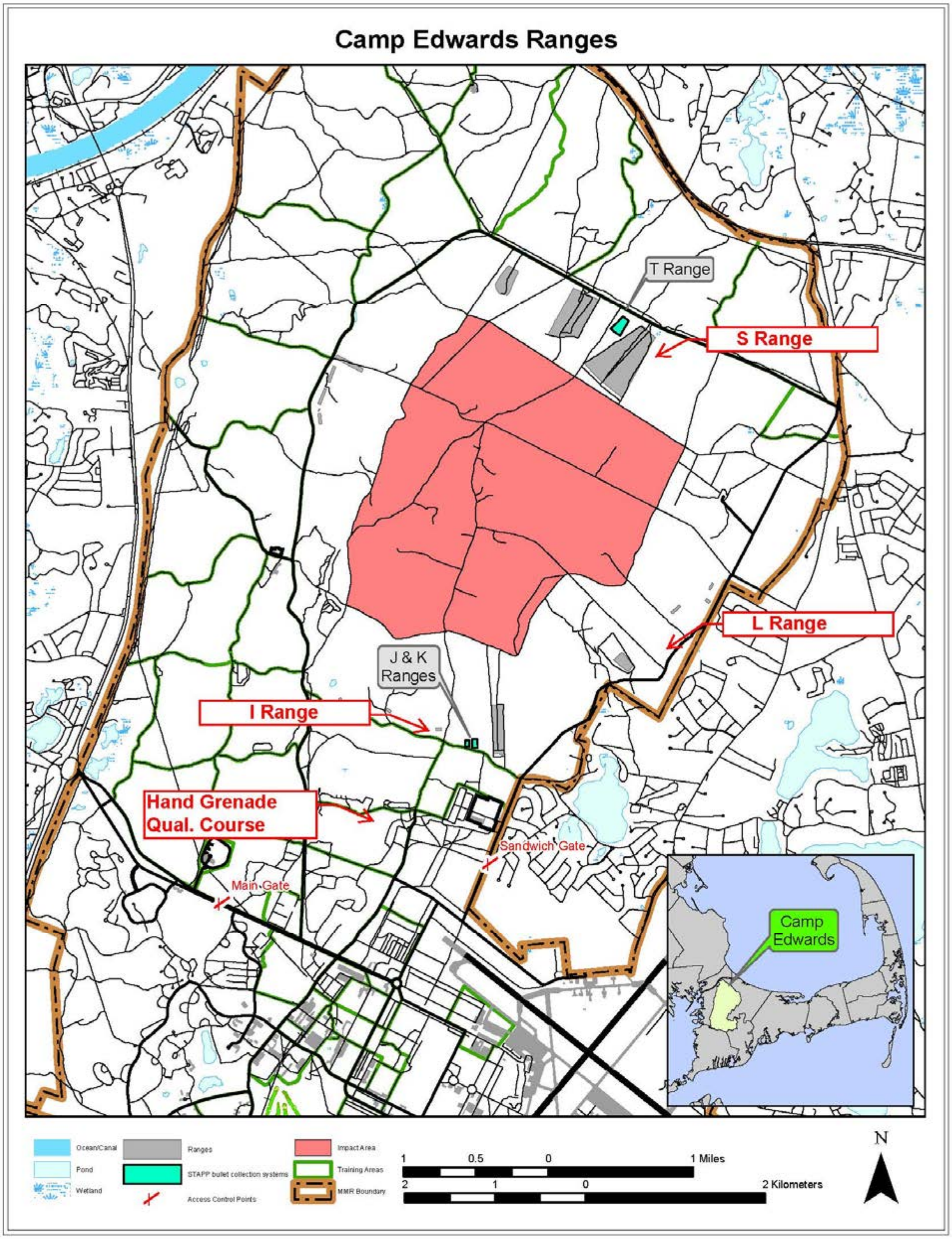
Comparison of the detected soil and groundwater concentrations to the action levels in the OMMP indicate that no range maintenance actions are needed at this time.

Elevated detections of antimony at concentrations exceeding the action level in several of the lysimeters have now been confirmed in several consecutive sampling rounds. It does not appear that ending the additions of lime to manipulate soil pH has had a significant impact on reducing pore water antimony concentrations. Careful monitoring of porewater should continue and further literature review and consultation with experts in the field of metals mobility will be undertaken as practical.

Soil, pore water, and groundwater samples will be collected again in the summer of 2015. In order to distinguish between dissolved and non-dissolved metals in the pore water and groundwater, both filtered and unfiltered samples will be collected in several locations during the 2015 sampling.

The data from replicate soil samples once again confirms that the soil sampling protocol is more than adequate to obtain reliable samples that meet the data quality requirements. It is recommended that replicate sampling is no longer needed as long as the same sampling methodology is used in 2015.

FIGURES


Camp Edwards Ranges
T Range
S Range
L Range
J & K
Ranges
I Range
Hand Grenade
Qual. Course
Sandwich Gate
Main Gate
Camp
Edwards
Ocean/Canal
Pond
Wetland
Ranges
STAPP bullet collection systems
Access Control Points
Impact Area
Training Areas
MMR Boundary
1 0.5 0 1 Miles
2 1 0 2 Kilometers
N

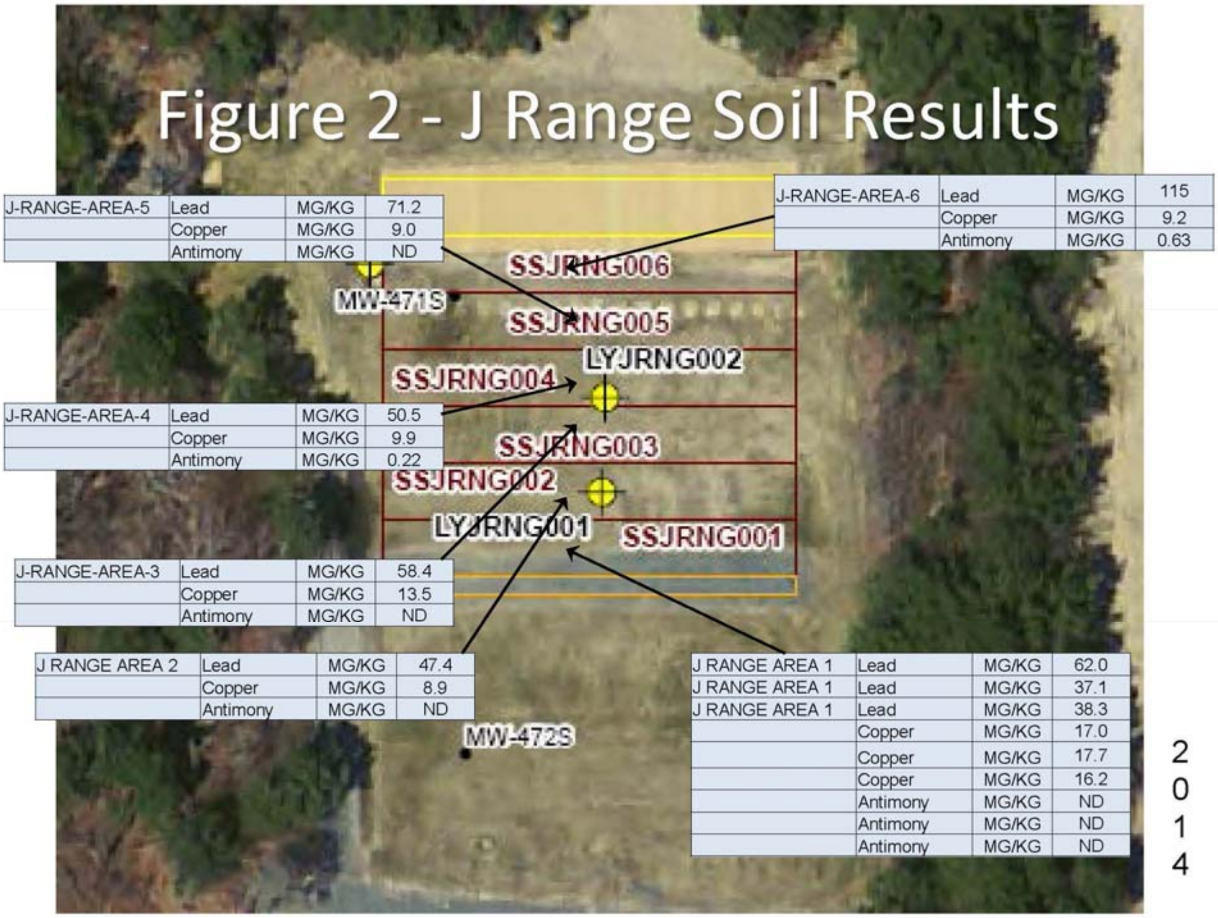


Figure 2 - J Range Soil Results
J-RANGE-AREA-5 Lead MG/KG 71.2
Copper MG/KG 9.0
Antimony MG/KG ND
J-RANGE-AREA-6 Lead MG/KG 115
Copper MG/KG 9.2
Antimony MG/KG 0.63
SSJRNG006
MW-471S
SSJRNG005
LYJRNG002
SSJRNG004
J-RANGE-AREA-4 Lead MG/KG 50.5
Copper MG/KG 9.9
Antimony MG/KG 0.22
SSJRNG003
SSJRNG002
LYJRNG001
SSJRNG001
J-RANGE-AREA-3 Lead MG/KG 58.4
Copper MG/KG 13.5
Antimony MG/KG ND
J RANGE AREA 2 Lead MG/KG 47.4
Copper MG/KG 8.9
Antimony MG/KG ND
J RANGE AREA 1 Lead MG/KG 62.0
J RANGE AREA 1 Lead MG/KG 37.1
J RANGE AREA 1 Lead MG/KG 38.3
Copper MG/KG 17.0
Copper MG/KG 17.7
Copper MG/KG 16.2
Antimony MG/KG ND
Antimony MG/KG ND
Antimony MG/KG ND
MW-472S
2014

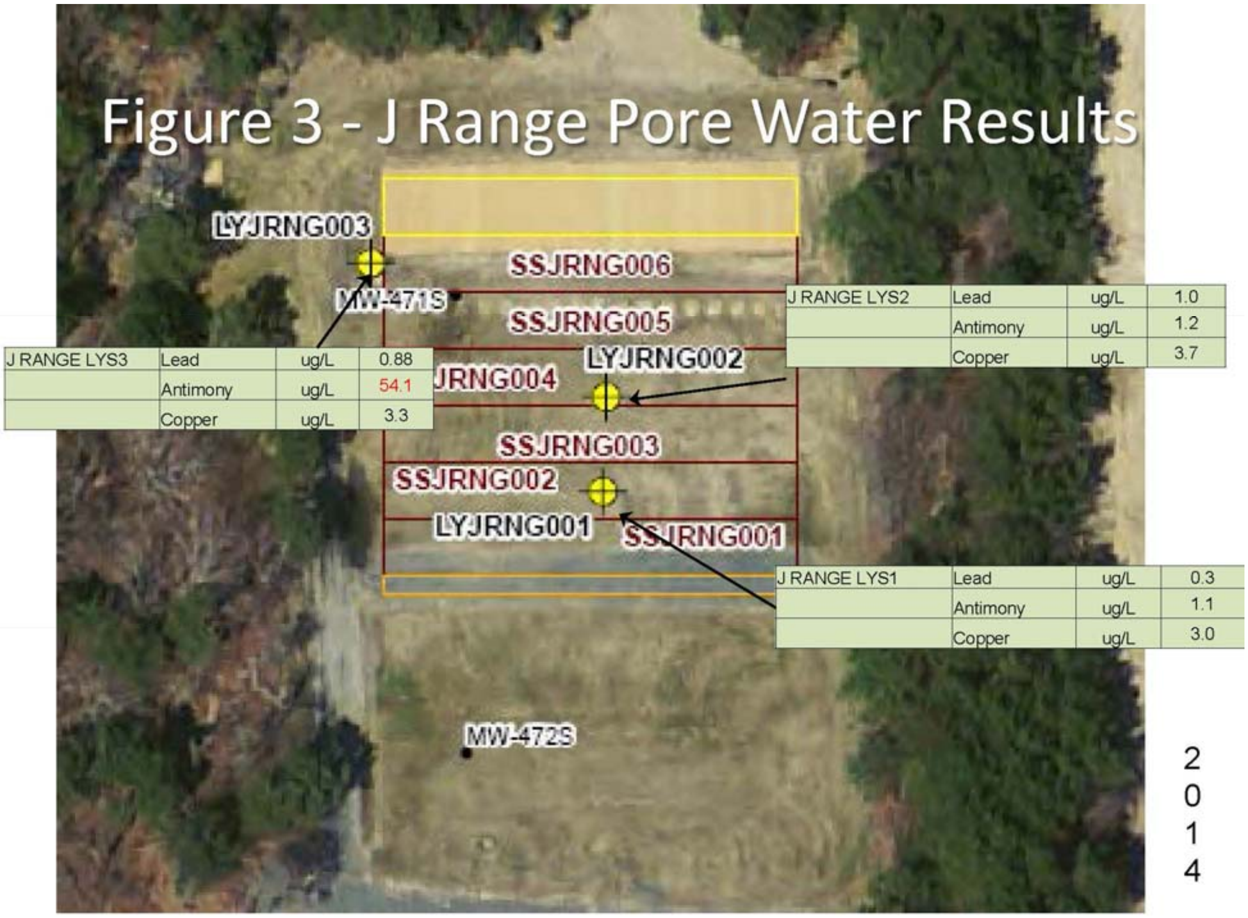


Figure 3 - J Range Pore Water Results
LYJRNG003
SSJRNG006
MW-471S
SSJRNG005
J RANGE LYS2 | Lead | ug/L | 1.0
Antimony | ug/L | 1.2
Copper | ug/L | 3.7
J RANGE LYS3 | Lead | ug/L | 0.88
Antimony | ug/L | 54.1
Copper | ug/L | 3.3
JRNG004
LYJRNG002
SSJRNG003
SSJRNG002
LYJRNG001
SSJRNG001
J RANGE LYS1 | Lead | ug/L | 0.3
Antimony | ug/L | 1.1
Copper | ug/L | 3.0
MW-472S
2
0
1
4

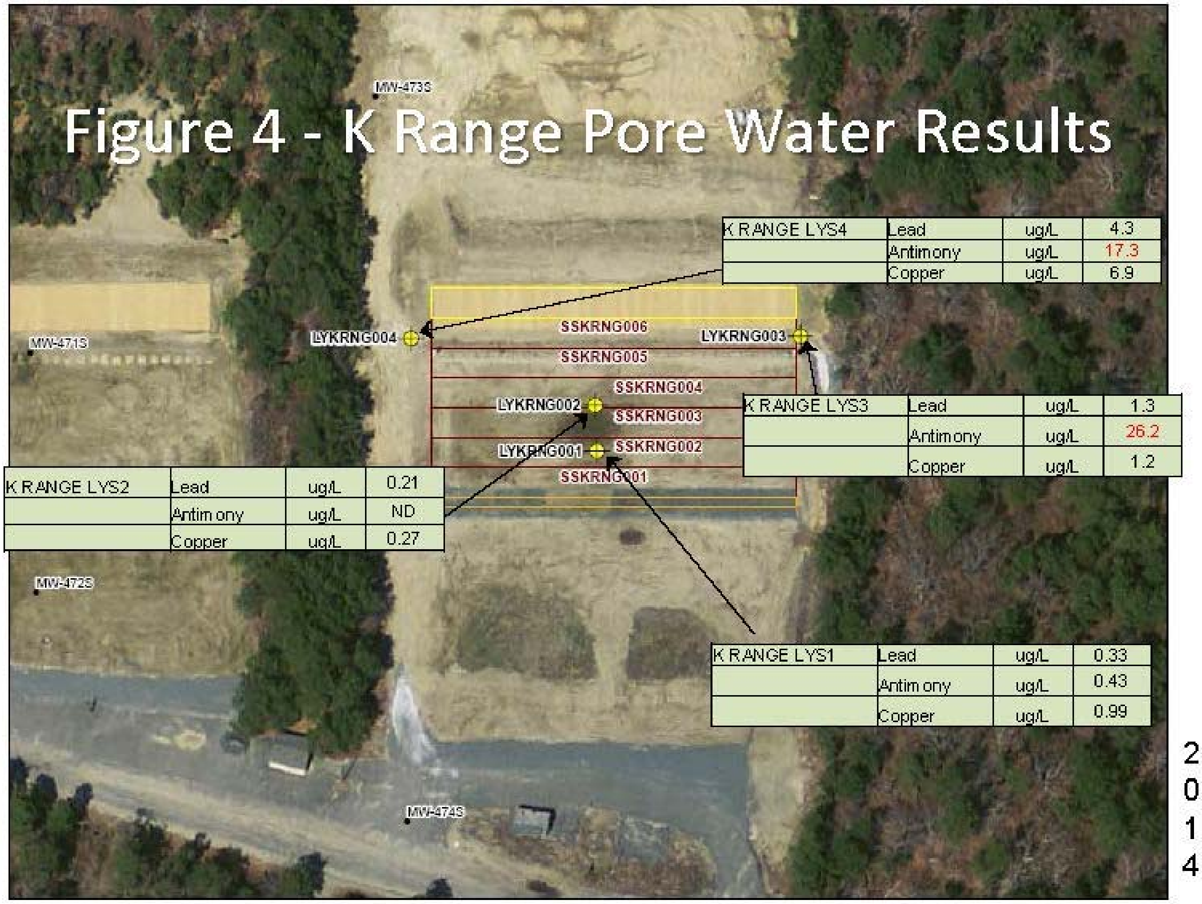


Figure 4 - K Range Pore Water Results
MW-473S
MW-471S
MW-472S
MW-474S
LYKRNG004
LYKRNG003
LYKRNG002
LYKRNG001
SSKRNG006
SSKRNG005
SSKRNG004
SSKRNG003
SSKRNG002
SSKRNG001
K RANGE LYS4 | Lead | ug/L | 4.3
Antimony | ug/L | 17.3
Copper | ug/L | 6.9
K RANGE LYS3 | Lead | ug/L | 1.3
Antimony | ug/L | 26.2
Copper | ug/L | 1.2
K RANGE LYS2 | Lead | ug/L | 0.21
Antim ony | ug/L | ND
Copper | ug/L | 0.27
K RANGE LYS1 | Lead | ug/L | 0.33
Antim ony | ug/L | 0.43
Copper | ug/L | 0.99
2
0
1
4

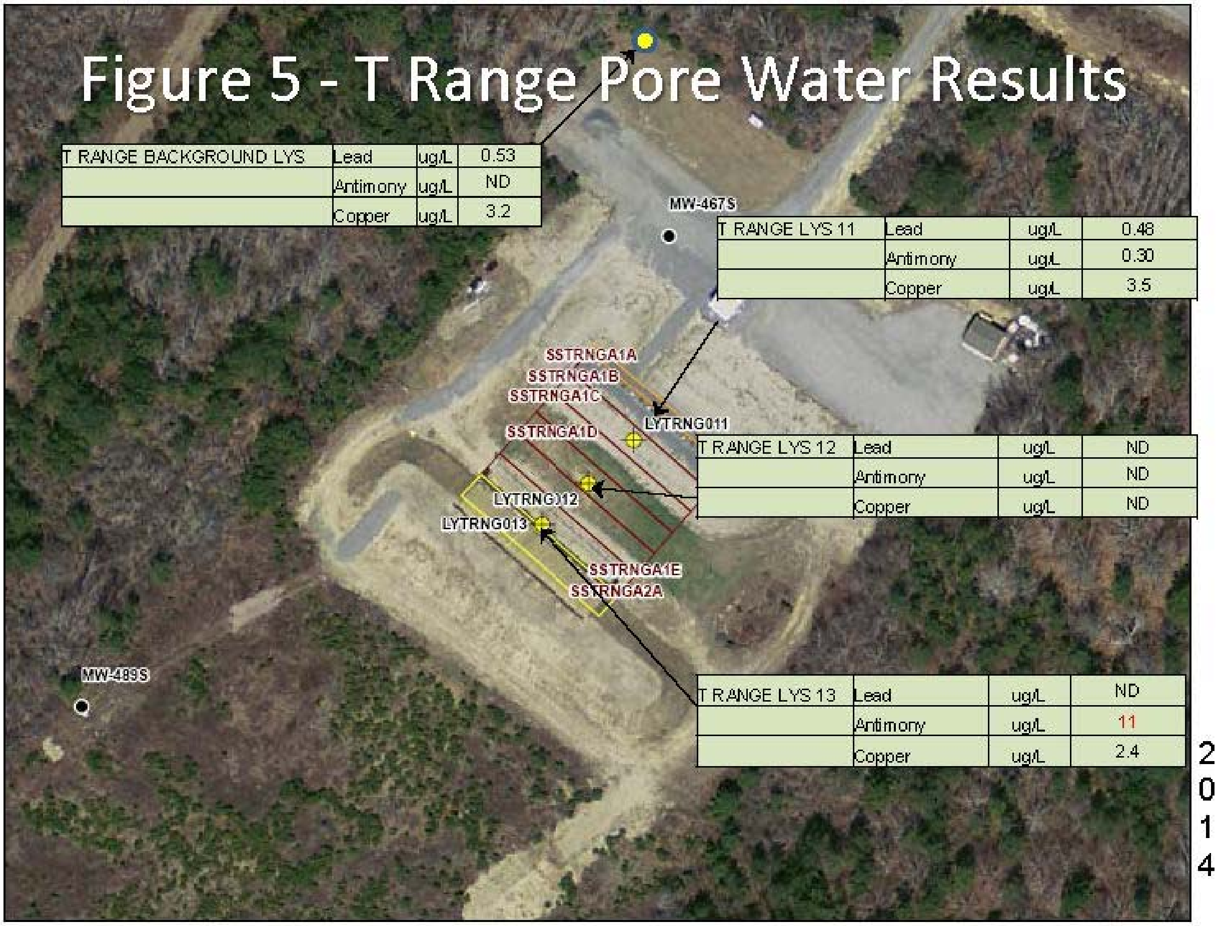


Figure 5 - T Range Pore Water Results
T RANGE BACKGROUND LYS
Lead ug/L 0.53
Antimony ug/L ND
Copper ug/L 3.2
MW-467S
T RANGE LYS 11
Lead ug/L 0.48
Antimony ug/L 0.30
Copper ug/L 3.5
SSTRNGA1A
SSTRNGA1B
SSTRNGA1C
SSTRNGA1D
LYTRNG011
T RANGE LYS 12
Lead ug/L ND
Antimony ug/L ND
Copper ug/L ND
LYTRNG012
LYTRNG013
SSTRNGA1E
SSTRNGA2A
MW-489S
T RANGE LYS 13
Lead ug/L ND
Antimony ug/L 11
Copper ug/L 2.4
2014

Figure 6
OMMP Action Levels

Table 11-1. Surface Soil Action Levels

Analyte	
Lead	3,000 mg/Kg
Antimony	300 mg/Kg
Copper	10,000 mg/Kg

mg/kg= milligrams per kilograms or ppm

Table 11-2. Pore Water Action Levels

Analyte	
Lead	15 ug/L
Antimony	6 ug/L
Copper	1300 ug/L

ug/L= micrograms per liter or ppb

Table 11-3. Groundwater Action Levels

Analyte	
Lead	7.5 ug/L
Antimony	3 ug/L
Copper	650 ug/L

ug/L= micrograms per liter or ppb

TABLES

Table 1
Soil Sample Results
August 2014

Site	Location ID	Field Sample ID	Date Sampled	Test Method	Analyte	Result Value	Qualifier	Units	MDL	RL	OMMP Action Levels (mg/Kg)	Sample Type	Remarks
J Range	SSJRNG001	SSJRNG001_AUG14A	08/21/2014	SW6010C	Antimony	ND	UJ	MG/KG	0.19	0.99	300	N1	100-pt MIS spl
J Range	SSJRNG001	SSJRNG001_AUG14A	08/21/2014	SW6010C	Copper	17.0	J	MG/KG	0.25	1.2	10,000	N1	100-pt MIS spl
J Range	SSJRNG001	SSJRNG001_AUG14A	08/21/2014	SW6010C	Lead	62.0	J	MG/KG	0.15	0.49	3,000	N1	100-pt MIS spl
J Range	SSJRNG001	SSJRNG001_AUG14B	08/21/2014	SW6010C	Antimony	ND	U	MG/KG	0.19	0.98	300	FR1	100-pt MIS spl
J Range	SSJRNG001	SSJRNG001_AUG14B	08/21/2014	SW6010C	Copper	17.7	J	MG/KG	0.25	1.2	10,000	FR1	100-pt MIS spl
J Range	SSJRNG001	SSJRNG001_AUG14B	08/21/2014	SW6010C	Lead	37.1	J	MG/KG	0.15	0.49	3,000	FR1	100-pt MIS spl
J Range	SSJRNG001	SSJRNG001_AUG14C	08/21/2014	SW6010C	Antimony	ND	U	MG/KG	0.19	1.0	300	FR2	100-pt MIS spl
J Range	SSJRNG001	SSJRNG001_AUG14C	08/21/2014	SW6010C	Copper	16.2	J	MG/KG	0.26	1.3	10,000	FR2	100-pt MIS spl
J Range	SSJRNG001	SSJRNG001_AUG14C	08/21/2014	SW6010C	Lead	38.3	J	MG/KG	0.15	0.50	3,000	FR2	100-pt MIS spl
J Range	SSJRNG002	SSJRNG002_AUG14A	08/21/2014	SW6010C	Antimony	ND	U	MG/KG	0.19	1.0	300	N1	100-pt MIS spl
J Range	SSJRNG002	SSJRNG002_AUG14A	08/21/2014	SW6010C	Copper	8.9	J	MG/KG	0.25	1.2	10,000	N1	100-pt MIS spl
J Range	SSJRNG002	SSJRNG002_AUG14A	08/21/2014	SW6010C	Lead	47.4	J	MG/KG	0.15	0.50	3,000	N1	100-pt MIS spl
J Range	SSJRNG003	SSJRNG003_AUG14A	08/21/2014	SW6010C	Antimony	ND	U	MG/KG	0.19	0.99	300	N1	100-pt MIS spl
J Range	SSJRNG003	SSJRNG003_AUG14A	08/21/2014	SW6010C	Copper	13.5	J	MG/KG	0.25	1.2	10,000	N1	100-pt MIS spl
J Range	SSJRNG003	SSJRNG003_AUG14A	08/21/2014	SW6010C	Lead	58.4	J	MG/KG	0.15	0.49	3,000	N1	100-pt MIS spl
J Range	SSJRNG004	SSJRNG004_AUG14A	08/21/2014	SW6010C	Antimony	0.22	J	MG/KG	0.19	1.0	300	N1	100-pt MIS spl
J Range	SSJRNG004	SSJRNG004_AUG14A	08/21/2014	SW6010C	Copper	9.9	J	MG/KG	0.25	1.2	10,000	N1	100-pt MIS spl
J Range	SSJRNG004	SSJRNG004_AUG14A	08/21/2014	SW6010C	Lead	50.5	J	MG/KG	0.15	0.50	3,000	N1	100-pt MIS spl
J Range	SSJRNG005	SSJRNG005_AUG14A	08/21/2014	SW6010C	Antimony	ND	U	MG/KG	0.19	1.0	300	N1	100-pt MIS spl
J Range	SSJRNG005	SSJRNG005_AUG14A	08/21/2014	SW6010C	Copper	9.0	J	MG/KG	0.26	1.3	10,000	N1	100-pt MIS spl
J Range	SSJRNG005	SSJRNG005_AUG14A	08/21/2014	SW6010C	Lead	71.2	J	MG/KG	0.15	0.50	3,000	N1	100-pt MIS spl
J Range	SSJRNG006	SSJRNG006_AUG14A	08/21/2014	SW6010C	Antimony	0.63	J	MG/KG	0.19	0.98	300	N1	100-pt MIS spl
J Range	SSJRNG006	SSJRNG006_AUG14A	08/21/2014	SW6010C	Copper	9.2	J	MG/KG	0.25	1.2	10,000	N1	100-pt MIS spl
J Range	SSJRNG006	SSJRNG006_AUG14A	08/21/2014	SW6010C	Lead	115	J	MG/KG	0.15	0.49	3,000	N1	100-pt MIS spl

Table 2
Lysimeter Sample Results August 2014

Site ID	Location ID	Field Sample ID	Date Sampled	Test Method	Analyte	Result Value	Qualifier	Units	MDL	RL	OMMP Action Levels (ug/L)
J Range	LYJRNG001	LYJRNG001_AUG14	08/18/2014	SW6020A	Antimony	1.1	J	UG/L	0.073	20.0	6.0
J Range	LYJRNG001	LYJRNG001_AUG14	08/18/2014	SW6020A	Copper	3.0	J	UG/L	0.23	20.0	1,300
J Range	LYJRNG001	LYJRNG001_AUG14	08/18/2014	SW6020A	Lead	0.3	J	UG/L	0.024	2.0	15
J Range	LYJRNG001	LYJRNG001_AUG14D	08/18/2014	SW6020A	Antimony	1.1	J	UG/L	0.073	20.0	6.0
J Range	LYJRNG001	LYJRNG001_AUG14D	08/18/2014	SW6020A	Copper	2.9	J	UG/L	0.23	20.0	1,300
J Range	LYJRNG001	LYJRNG001_AUG14D	08/18/2014	SW6020A	Lead	0.21	J	UG/L	0.024	2.0	15
J Range	LYJRNG002	LYJRNG002_AUG14	08/18/2014	SW6020A	Antimony	1.2	J	UG/L	0.073	20.0	6.0
J Range	LYJRNG002	LYJRNG002_AUG14	08/18/2014	SW6020A	Copper	3.7	J	UG/L	0.23	20.0	1,300
J Range	LYJRNG002	LYJRNG002_AUG14	08/18/2014	SW6020A	Lead	1.0	J	UG/L	0.024	2.0	15
J Range	LYJRNG003	LYJRNG003_AUG14	08/18/2014	SW6020A	Antimony	54.1		UG/L	0.073	20.0	6.0
J Range	LYJRNG003	LYJRNG003_AUG14	08/18/2014	SW6020A	Copper	3.3	J	UG/L	0.23	20.0	1,300
J Range	LYJRNG003	LYJRNG003_AUG14	08/18/2014	SW6020A	Lead	0.88	J	UG/L	0.024	2.0	15
K Range	LYKRBGD01	LYKRBGD01_AUG14	08/18/2014	SW6020A	Antimony	0.43	J	UG/L	0.073	20.0	6.0
K Range	LYKRBGD01	LYKRBGD01_AUG14	08/18/2014	SW6020A	Copper	0.79	J	UG/L	0.23	20.0	1,300
K Range	LYKRBGD01	LYKRBGD01_AUG14	08/18/2014	SW6020A	Lead	0.084	J	UG/L	0.024	2.0	15
K Range	LYKRNG001	LYKRNG001_AUG14	08/18/2014	SW6020A	Antimony	0.11	J	UG/L	0.073	20.0	6.0
K Range	LYKRNG001	LYKRNG001_AUG14	08/18/2014	SW6020A	Copper	0.99	J	UG/L	0.23	20.0	1,300
K Range	LYKRNG001	LYKRNG001_AUG14	08/18/2014	SW6020A	Lead	0.33	J	UG/L	0.024	2.0	15
K Range	LYKRNG002	LYKRNG002_AUG14	08/18/2014	SW6020A	Antimony	ND	U	UG/L	0.073	20.0	6.0
K Range	LYKRNG002	LYKRNG002_AUG14	08/18/2014	SW6020A	Copper	0.27	J	UG/L	0.23	20.0	1,300
K Range	LYKRNG002	LYKRNG002_AUG14	08/18/2014	SW6020A	Lead	0.21	J	UG/L	0.024	2.0	15
K Range	LYKRNG003	LYKRNG003_AUG14	08/18/2014	SW6020A	Antimony	26.2		UG/L	0.073	20.0	6.0
K Range	LYKRNG003	LYKRNG003_AUG14	08/18/2014	SW6020A	Copper	1.2	J	UG/L	0.23	20.0	1,300
K Range	LYKRNG003	LYKRNG003_AUG14	08/18/2014	SW6020A	Lead	1.7	J	UG/L	0.024	2.0	15
K Range	LYKRNG004	LYKRNG004_AUG14	08/18/2014	SW6020A	Antimony	17.3	J	UG/L	0.073	20.0	6.0
K Range	LYKRNG004	LYKRNG004_AUG14	08/18/2014	SW6020A	Copper	6.9	J	UG/L	0.23	20.0	1,300
K Range	LYKRNG004	LYKRNG004_AUG14	08/18/2014	SW6020A	Lead	4.3		UG/L	0.024	2.0	15
T Range	LYTRBGD01	LYTRBGD01_AUG14	08/20/2014	SW6020A	Antimony	ND	U	UG/L	0.073	20.0	6.0
T Range	LYTRBGD01	LYTRBGD01_AUG14	08/20/2014	SW6020A	Copper	3.2	J	UG/L	0.23	20.0	1,300
T Range	LYTRBGD01	LYTRBGD01_AUG14	08/20/2014	SW6020A	Lead	0.53	J	UG/L	0.024	2.0	15
T Range	LYTRNG011	LYTRNG011_AUG14	08/20/2014	SW6020A	Antimony	0.30	J	UG/L	0.073	20.0	6.0
T Range	LYTRNG011	LYTRNG011_AUG14	08/20/2014	SW6020A	Copper	3.5	J	UG/L	0.23	20.0	1,300
T Range	LYTRNG011	LYTRNG011_AUG14	08/20/2014	SW6020A	Lead	0.46	J	UG/L	0.024	2.0	15
T Range	LYTRNG011	LYTRNG011_AUG14D	08/20/2014	SW6020A	Antimony	0.31	J	UG/L	0.073	20.0	6.0
T Range	LYTRNG011	LYTRNG011_AUG14D	08/20/2014	SW6020A	Copper	4.0	J	UG/L	0.23	20.0	1,300
T Range	LYTRNG011	LYTRNG011_AUG14D	08/20/2014	SW6020A	Lead	0.63	J	UG/L	0.024	2.0	15
T Range	LYTRNG012	LYTRNG012_AUG14	08/20/2014	SW6020A	Antimony	ND	U	UG/L	0.073	20.0	6.0
T Range	LYTRNG012	LYTRNG012_AUG14	08/20/2014	SW6020A	Copper	ND	U	UG/L	0.23	20.0	1,300
T Range	LYTRNG012	LYTRNG012_AUG14	08/20/2014	SW6020A	Lead	ND	U	UG/L	0.024	2.0	15
T Range	LYTRNG013	LYTRNG013_AUG14	08/20/2014	SW6020A	Antimony	11	J	UG/L	0.073	20.0	6.0
T Range	LYTRNG013	LYTRNG013_AUG14	08/20/2014	SW6020A	Copper	2.4	J	UG/L	0.23	20.0	1,300
T Range	LYTRNG013	LYTRNG013_AUG14	08/20/2014	SW6020A	Lead	ND	U	UG/L	0.024	2.0	15

TABLE 3
Small Arms Range Historic Groundwater Sample Results
2011 to 2014

Site/SLX List	Location ID	Top Depth (ft bgs)	Bottom Depth (ft bgs)	Test Method	Analyte	2011 Result Value	2012 Result Value	2013 Result Value	2014 Result Value	Units	MDL	RL
J RANGE	MW-471S	84.59	94.59	SW6020A	Antimony	ND	ND	0.19	0.15	UG/L	0.073	4.0
J RANGE	MW-471S	84.59	94.59	SW6020A	Copper	3.3	0.30	2.7	7.8	UG/L	0.23	20.0
J RANGE	MW-471S	84.59	94.59	SW6020A	Lead	ND	ND	1.6	4.1	UG/L	0.024	2.0
J RANGE	MW-472S	85.31	95.31	SW6020A	Antimony	ND	ND	ND	ND	UG/L	0.073	4.0
J RANGE	MW-472S	85.31	95.31	SW6020A	Copper	1	1.4	0.73	0.61	UG/L	0.23	20.0
J RANGE	MW-472S	85.31	95.31	SW6020A	Lead	ND	ND	ND	0.078	UG/L	0.024	2.0
K RANGE	MW-473S	83.38	93.38	SW6020A	Antimony	ND	ND	0.19	NS	UG/L	0.073	4.0
K RANGE	MW-473S	83.38	93.38	SW6020A	Copper	0.31	1.2	3.4	NS	UG/L	0.23	20.0
K RANGE	MW-473S	83.38	93.38	SW6020A	Lead	ND	0.18	ND	NS	UG/L	0.024	2.0
K RANGE	MW-474S	86.44	96.44	SW6020A	Antimony	ND	ND	0.48	0.098	UG/L	0.073	4.0
K RANGE	MW-474S	86.44	96.44	SW6020A	Copper	ND	0.82	3.6	3.0	UG/L	0.23	20.0
K RANGE	MW-474S	86.44	96.44	SW6020A	Lead	ND	0.042	0.78	1.5	UG/L	0.024	2.0
T RANGE	MW-467S	124.94	134.94	SW6020A	Antimony	ND	ND	0.14	ND	UG/L	0.073	4.0
T RANGE	MW-467S	124.94	134.94	SW6020A	Copper	ND	0.26	15.7	ND	UG/L	0.23	20.0
T RANGE	MW-467S	124.94	134.94	SW6020A	Lead	ND	0.097	3.1	0.48	UG/L	0.024	2.0

Note - Well MW-489S was also sampled under the OMMP until 2011. Well MW-473S is no longer sampled as of 2014.
NS=Not Sampled

B= Blank contamination
ND/U = Non Detect
J = Estimated result

ug/L = microgram/liter
MDL = Method Detection Limit
RL = Reporting Limit

TABLE 3
Small Arms Range Historic Groundwater Sample Results
2011 to 2014

Site/SLX List	Location ID	Top Depth (ft bgs)	Bottom Depth (ft bgs)	Test Method	Analyte	2011 Result Value	2012 Result Value	2013 Result Value	2014 Result Value	Units	MDL	RL
J RANGE	MW-471S	84.59	94.59	SW6020A	Antimony	ND	ND	0.19	0.15	UG/L	0.073	4.0
J RANGE	MW-471S	84.59	94.59	SW6020A	Copper	3.3	0.30	2.7	7.8	UG/L	0.23	20.0
J RANGE	MW-471S	84.59	94.59	SW6020A	Lead	ND	ND	1.6	4.1	UG/L	0.024	2.0
J RANGE	MW-472S	85.31	95.31	SW6020A	Antimony	ND	ND	ND	ND	UG/L	0.073	4.0
J RANGE	MW-472S	85.31	95.31	SW6020A	Copper	1	1.4	0.73	0.61	UG/L	0.23	20.0
J RANGE	MW-472S	85.31	95.31	SW6020A	Lead	ND	ND	ND	0.078	UG/L	0.024	2.0
K RANGE	MW-473S	83.38	93.38	SW6020A	Antimony	ND	ND	0.19	NS	UG/L	0.073	4.0
K RANGE	MW-473S	83.38	93.38	SW6020A	Copper	0.31	1.2	3.4	NS	UG/L	0.23	20.0
K RANGE	MW-473S	83.38	93.38	SW6020A	Lead	ND	0.18	ND	NS	UG/L	0.024	2.0
K RANGE	MW-474S	86.44	96.44	SW6020A	Antimony	ND	ND	0.48	0.098	UG/L	0.073	4.0
K RANGE	MW-474S	86.44	96.44	SW6020A	Copper	ND	0.82	3.6	3.0	UG/L	0.23	20.0
K RANGE	MW-474S	86.44	96.44	SW6020A	Lead	ND	0.042	0.78	1.5	UG/L	0.024	2.0
T RANGE	MW-467S	124.94	134.94	SW6020A	Antimony	ND	ND	0.14	ND	UG/L	0.073	4.0
T RANGE	MW-467S	124.94	134.94	SW6020A	Copper	ND	0.26	15.7	ND	UG/L	0.23	20.0
T RANGE	MW-467S	124.94	134.94	SW6020A	Lead	ND	0.097	3.1	0.48	UG/L	0.024	2.0

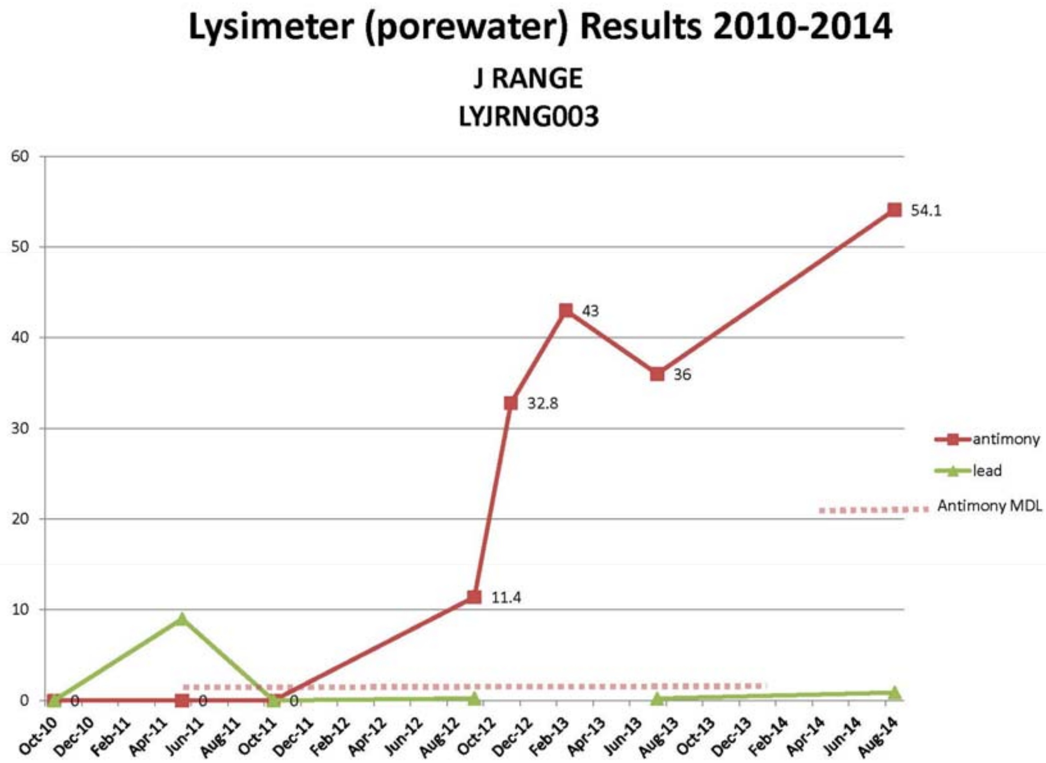
Note - Well MW-489S was also sampled under the OMMP until 2011. Well MW-473S is no longer sampled as of 2014.
NS=Not Sampled

B= Blank contamination
ND/U = Non Detect
J = Estimated result

ug/L = microgram/liter
MDL = Method Detection Limit
RL = Reporting Limit

Page 1 of 1

ATTACHMENTS


Lysimeter (porewater) Results 2010-2014
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LYJRNG003
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50
40
30
20
10
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54.1
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32.8
11.4
0
0
0
antimony
lead
Antimony MDL
Oct-10
Dec-10
Feb-11
Apr-11
Jun-11
Aug-11
Oct-11
Dec-11
Feb-12
Apr-12
Jun-12
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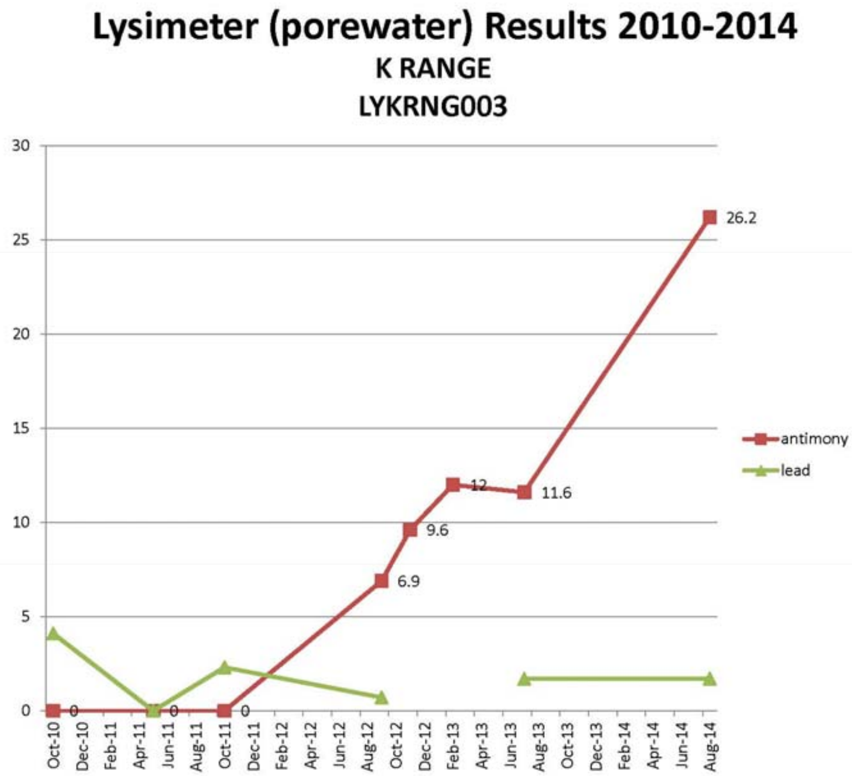
Lysimeter (porewater) Results 2010-2014
K RANGE
LYKRNG003
30
25
20
15
10
5
0
26.2
12
11.6
9.6
6.9
0
0
0
antimony
lead
Oct-10
Dec-10
Feb-11
Apr-11
Jun-11
Aug-11
Oct-11
Dec-11
Feb-12
Apr-12
Jun-12
Aug-12
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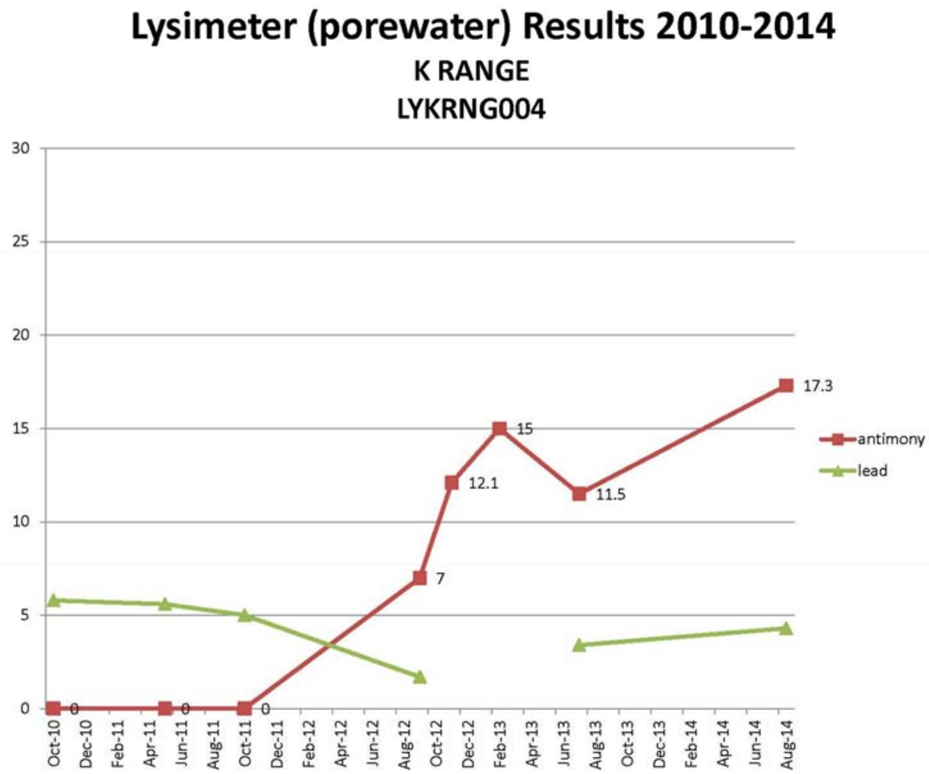
Lysimeter (porewater) Results 2010-2014
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25
20
15
10
5
0
0
0
0
7
12.1
15
11.5
17.3
antimony
lead
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Dec-10
Feb-11
Apr-11
Jun-11
Aug-11
Oct-11
Dec-11
Feb-12
Apr-12
Jun-12
Aug-12
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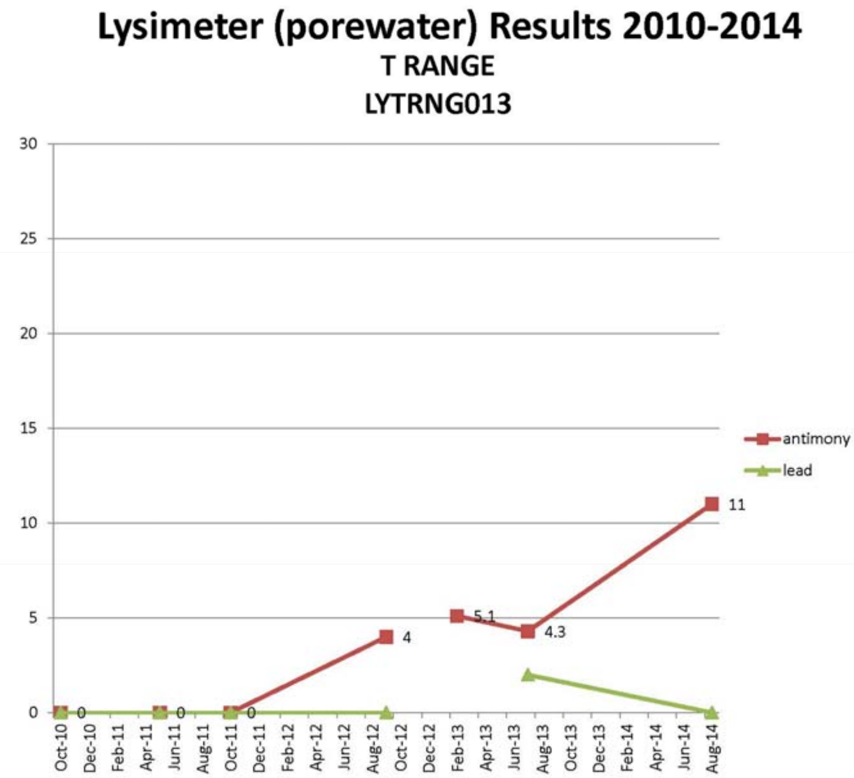
Apr-14
Jun-14
Aug-14


Lysimeter (porewater) Results 2010-2014
T RANGE
LYTRNG013
30
25
20
15
10
5
0
antimony
lead
0
0
0
4
5.1
4.3
11
Oct-10
Dec-10
Feb-11
Apr-11
Jun-11
Aug-11
Oct-11
Dec-11
Feb-12
Apr-12
Jun-12
Aug-12
Oct-12
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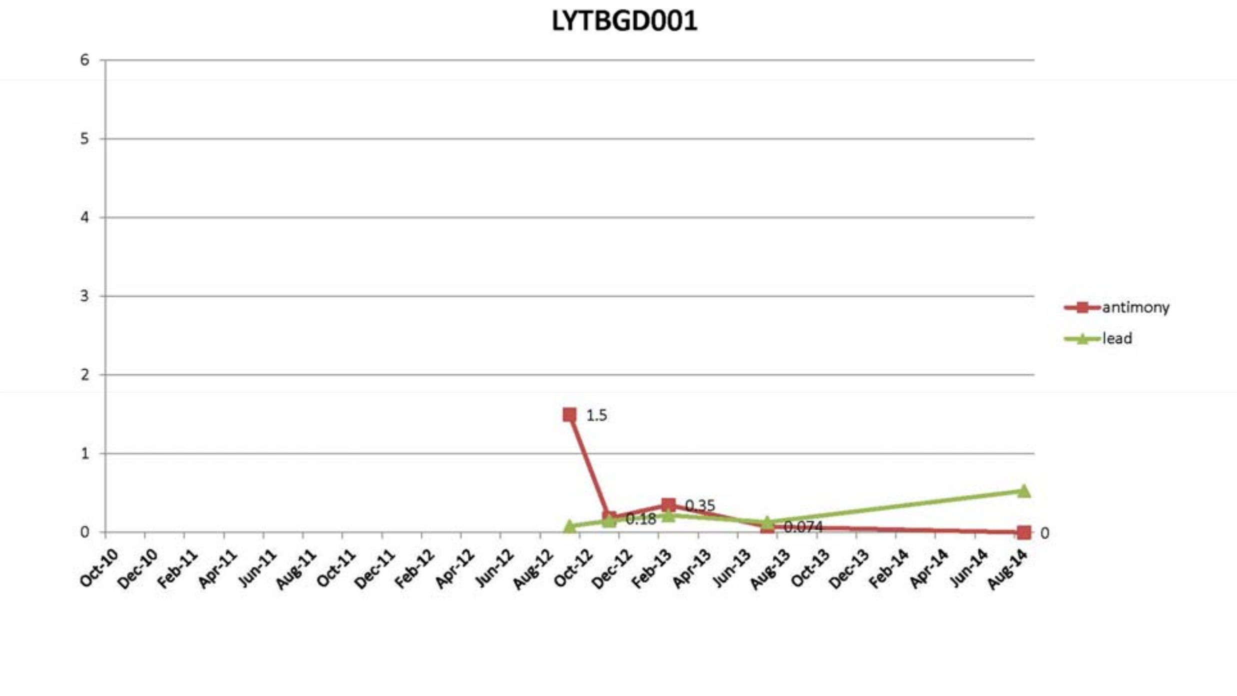
Metals in Background Lysimeter



APPENDIX C

Chapter 47 of the Acts of 2002
Environmental Performance Standards

Chapter 47 of the Acts of 2002

AN ACT RELATIVE TO THE ENVIRONMENTAL PROTECTION OF THE MASSACHUSETTS MILITARY RESERVATION.

Be it enacted by the Senate and House of Representatives in General Court assembled, and by the authority of the same, as follows:

SECTION 1. As used in this act, the following terms shall, unless the context otherwise requires, have the following meanings:-

"Commission", the environmental management commission established in section 4.

"Environmental performance standards", the environmental performance standards included in the final environmental impact report regarding the activities on the northern 15,000 acres of the Massachusetts military reservation, promulgated under sections 61 to 62H, inclusive, of chapter 30 of the General Laws and certified by the secretary of environmental affairs on July 16, 2001.

"Massachusetts military reservation" or "MMR", approximately 22,000 acres of land owned by the commonwealth in Barnstable county established under chapter 196 of the acts of 1935, chapters 320 and 344 of the acts of 1936, chapter 5 of the acts of 1941, chapter 665 of the acts of 1955 and chapter 617 of the acts of 1956, and used primarily for military purposes.

"Special military reservation commission", the commission provided with jurisdiction over the MMR under chapter 196 of the acts of 1935.

"Upper cape water supply reserve" or "reserve", a parcel of land within the MMR of 15,000 acres, more or less, owned by the commonwealth as described in a plan prepared by the executive office of environmental affairs and filed with the division of capital asset management and maintenance; but the reserve shall not include a portion of the parcel containing approximately 29 acres and associated corridors for providing services and underground utility services, to be used in connection with the construction and operation of a jail and house of correction as shown on the plan.

SECTION 2. The Upper Cape Water Supply Reserve shall be public conservation land and shall be dedicated to: (*a*) the natural resource purposes of water supply and wildlife habitat protection and the development and construction of public water supply systems, and (*b*) the use and training of the military forces of the commonwealth; provided that, such military use and training is compatible with the natural resource purposes of water supply and wildlife habitat protection.

SECTION 3. Notwithstanding any general or special law to the contrary, the commissioner of capital asset management and maintenance shall transfer the custody, care and control of the reserve, subject to any applicable lease agreements regarding the reserve, from the special military reservation commission to the division of fisheries and wildlife of the department of fisheries, wildlife and environmental law enforcement by August 1, 2002. The division of fisheries and wildlife of the department of fisheries, wildlife and environmental law enforcement may acquire care, custody and control of the reserve, subject to the requirements of this act and any applicable lease agreements regarding the reserve, for natural resource purposes, as limited and further described in section 2. The transfer shall include all books, records, documents, agreements, contracts, leases and other materials necessary for the commission to operate and manage the reserve.

SECTION 4. There is hereby created within the executive office of environmental affairs an environmental management commission. The commission shall consist of the following 3 ex officio members: the commissioner of the department of fisheries, wildlife and environmental law enforcement; the commissioner of environmental management; and the commissioner of environmental protection. Notwithstanding any general or special law to the contrary, but subject to any applicable lease agreements regarding the reserve, the commission shall oversee and monitor the military and other activities on the reserve in accordance with the purposes and provisions of this act.

SECTION 5. The purpose of the commission shall be to ensure the permanent protection of the drinking water supply and wildlife habitat of the reserve. The commission shall ensure, by oversight, monitoring and evaluation, that all military and other activities on the reserve are consistent with this purpose. The commission shall oversee compliance with and enforcement of the environmental performance standards, coordinate the actions of the environmental agencies of the commonwealth in the enforcement of environmental laws and regulations at the reserve, as appropriate and facilitate an open and public review of all activities on the reserve.

SECTION 6. The commission shall be assisted by 2 advisory councils:

(*a*) a community advisory council, which shall be comprised of the following members: 1 representative of each of the towns of Falmouth, Bourne, Sandwich and Mashpee; 1 family member resident of the MMR; 2 representatives of the military; 1 representative of the Cape Cod commission; 1 representative of the Upper Cape Regional Water Supply Cooperative; 1 representative of the Wampanoag Tribe; and 5 other members to be appointed by the governor, but the town representatives shall be recommended by the towns' respective boards of selectmen; the family member resident of the MMR shall be selected from among a list of 5 persons provided by the commander of the Coast Guard Air Station Cape Cod; the military representatives shall be recommended by the military division of the commonwealth; the Cape Cod commission representative shall be recommended by the Cape Cod commission; the Upper Cape Regional Water Supply Cooperative representative shall be recommended by the Upper Cape Regional Water Supply Cooperative; and the Wampanoag Tribe representative shall be recommended by the tribal leadership. The community advisory council shall assist the commission by providing advice on issues related to the protection of the water supply and wildlife habitat on the reserve, and (*b*) a science advisory council, which shall be appointed by the governor and shall be comprised of 5 to 9 scientists and engineers who are recognized for their expertise in the areas of public health, water protection, wildlife habitat management or land use management. The science advisory council shall assist the commission by providing scientific and technical advice relating to the protection of the drinking water supply and wildlife habitat on the reserve.

SECTION 7. The powers of the commission shall include, but not be limited to, the following:-

(*a*) to hire staff, including an environmental officer;

(*b*) to enter into contracts;

(*c*) to acquire real or personal property or interests or rights therein if necessary for the management of the reserve;

(*d*) to accept funds or property from any source, public or private, including gifts, bequests, grants, contributions and settlements, judgments, fines or penalties in order to assist in the discharge of its duties;

(*e*) to expend funds from the trust fund established in section 14;

(*f*) to promulgate rules, regulations, guidelines and procedures as necessary for the administration of the commission and the advisory councils and as necessary for the effective performance of its responsibilities and duties under this act.

SECTION 8. The commission shall hire an environmental officer for the MMR. The environmental officer shall report to the commission. The duties and responsibilities of the environmental officer shall be to monitor the activities being conducted on, and the uses of, the reserve and the impact of such activities and uses on the water supply and wildlife habitat. The environmental officer shall also coordinate with appropriate personnel from the department of fisheries, wildlife and environmental law enforcement, the department of environmental management and the department of environmental protection to monitor and evaluate the environmental impact of activities conducted on and uses of the reserve. The personnel of the department of fisheries, wildlife and environmental law enforcement, the department of environmental management and the department of environmental protection shall support and assist the commission and cooperate with the environmental officer.

The environmental officer shall have an office located within the environmental readiness center or such other location on the MMR as may be appropriate to carry out his duties. The national guard shall provide such office space and allow the environmental officer, acting on behalf of the commission, regular and unrestricted access to all data and information from the various environmental and management programs and activities operating on the MMR. These programs and activities include, but are not limited to: the integrated training area management program; the integrated natural resources management plan; the integrated cultural resources management plan; Camp Edwards' standard operating procedures; and any other program or activity created by the army or the national guard for the purpose of managing or maintaining the northern 15,000 acres of the MMR. Access to data and information shall not include restricted or classified information, unless the environmental officer obtains the appropriate level of security clearance. The national guard shall use its best efforts to assist the environmental officer in obtaining the appropriate level of security clearance. The national guard shall also submit all draft and final impact area groundwater study reports to the commission for its information, as soon as they become available.

The commission, its staff and, as determined to be necessary by the commission, personnel of the department of fisheries, wildlife and environmental law enforcement, the department of environmental management and the department of environmental protection, shall access and inspect the reserve in order to monitor, oversee, evaluate and report to the commission on the environmental impact of military training and all other activities. As determined to be necessary by the commission, such access shall occur prior to, during and immediately following training or other activities upon notice, in accordance with Camp Edwards' standard operating procedures, regulations and security requirements.

SECTION 9. (*a*) The national guard shall provide the commission with an annual report describing in detail: (1) the nature and extent of military training and other activities; (2) all resource management activities; (3) the status of compliance with applicable federal and state environmental laws and regulations and the environmental performance standards; and (4) long-term trends in the major areas of resource management and activities. The commission shall make the report available to the public.

(*b*) The national guard shall notify the commission, in writing and within 2 business days after discovery, of any violation of an environmental performance standard. The notification shall include the nature and extent of the violation and any corrective action that has been taken or will be taken to return to compliance. With respect to a violation of federal or state law that is reported to a federal or state agency, the national guard shall provide the commission with a copy of any notice provided to the federal or state agency.

(*c*) The national guard shall notify the commission, in writing and within 2 business days after the discovery, of any damage or threat of damage to the drinking water supply or wildlife habitat, even if the damage results, or may result from, an activity that is otherwise compliant with law, regulation or environmental performance standards. Damage shall not include any insignificant damage to these resources, consistent with regulations promulgated by the executive office of environmental affairs pursuant to sections 61 to 62H, inclusive, of chapter 30 of the General Laws.

SECTION 10. (*a*) The commission shall evaluate all information and data regarding the activities and uses of the reserve and the environmental impact upon the drinking water supply and wildlife habitat of the reserve and may take action, as described in subsection (*b*) and (*c*). The commission may consult with the science advisory council, the community advisory council, or other entities in evaluating such information and in taking such action.

(*b*) If the commission determines that a user has violated or is violating an environmental performance standard, the commission shall notify the violator of the violation and may: (1) in the case of imminent and substantial damage, order that any activity creating a violation cease immediately, or require adjustments in the activity to eliminate the imminent and substantial damage or threat of damage; or (2) in all other cases, require the violator to return to compliance within a reasonable time and to notify the commission of the corrective action taken, including steps to ensure future compliance. Repeated or willful violations of an environmental performance standard may result in sanctions including cessation of activities.

(*c*) If the commission determines, based upon sound and accepted scientific analysis and evidence, that an activity that is otherwise compliant with law, regulation or environmental performance standards, is causing or threatens to cause imminent and substantial damage to the drinking water supply or wildlife habitat of the reserve, the commission may: (1) order such activity to cease immediately; or (2) require adjustments in the activity to eliminate the imminent and substantial damage or threat of damage.

(*d*) After consultation with the science advisory council and the community advisory council, the commission may adjust environmental performance standards based upon sound and accepted scientific analysis, monitoring data and other relevant information. The proponent of any adjustment shall bear the burden of justifying the proposed adjustment and demonstrating that the proposed adjustment is protective of the drinking water supply and wildlife habitat. If the commission determines that a proposed adjustment may be warranted and does not significantly reduce the standard of environmental protection, it shall publish a notice of availability of the proposed adjustment to the environmental performance standards in the *Environmental Monitor* published by the executive office of environmental affairs, furnish copies to all members of the community advisory council and the science advisory council, and accept public comment for a period of at least 30 days following the publication date. Thereafter, the proposed environmental performance standard will become effective on a date determined by the commission. The commission shall not consider adjustments to the environmental performance standards prior to submission of the first state of the reservation report to be filed under sections 61 to 62H, inclusive, of chapter 30 of the General Laws on or about January 1, 2003, unless such an adjustment is necessary to abate imminent and substantial damage or for national security reasons.

SECTION 11. (*a*) Prior to issuing an order or deciding an issue that does not involve imminent and substantial damage, the commission shall provide the military with an opportunity to be heard.

(*b*) If the commission issues an order to cease or adjust an activity to avoid imminent and substantial damage, the commission shall provide the military an opportunity to be heard on the matter within 2 business days after issuing the order.

(*c*) The military may request reconsideration of any decision or order of the commission by submitting its concerns in writing. The commission shall consider all such requests. The commission shall reconsider its decision or order, in light of all relevant information, and affirm, amend or reverse its decision or order and so indicate in writing within 30 days, unless such time is further extended by mutual agreement of the parties.

The Massachusetts national guard shall comply with all decisions and orders of the commission, provided such decisions or orders do not conflict with federal or state law.

The Massachusetts national guard and any other user of the reserve shall immediately cease or adjust any activity that, in the determination of the Massachusetts national guard, causes or threatens to cause imminent and substantial damage to the drinking water supply or the wildlife habitat.

In the case of an order by the commission to abate an activity that causes or threatens to cause imminent and substantial damage to the drinking water supply or wildlife habitat, the Massachusetts national guard shall cease the activity while any request for reconsideration is pending.

SECTION 12. The state environmental agencies on the commission retain all their respective, independent enforcement authority. In response to an enforcement action brought by one of the state environmental agencies, including the department of fisheries, wildlife and environmental law enforcement, the department of environmental management and the department of environmental protection, members of the commission shall work together to implement coordinated actions at the reserve. In order to avoid, minimize and mitigate any negative impacts, they shall, in good faith and where appropriate, seek comment and input from one another, the military and the public before issuing decisions or taking actions at the reserve.

SECTION 13. There shall be established and set up on the books of the commonwealth a separate fund to be known as the Upper Cape Water Supply Reserve Trust Fund to be administered and expended by the commission. Expenditures may be made from the trust fund, without further appropriation, for the costs associated with activities deemed appropriate by the commission in furtherance of its powers as described in this act. The fund shall retain all interest earned on sums deposited. The fund may receive such funds as may be appropriated from time to time, as well as gifts and grants of money or other contributions from any source, either public or private, and settlements, judgments, fines or penalties not designated by law for other specific purposes, to be expended for the purposes of the fund.

SECTION 14. Nothing in this act shall in any way affect existing rights, duties and liabilities as they have been or may be determined in the future relating to any pollution or other contamination of the Upper Cape Water Supply Reserve, including but not limited to contamination of soil, groundwater, surface water, current or potential drinking water supplies or the existence of unexploded ordnance, whether arising under federal, state or local law, including any statute, regulation or judicial or administrative order or decision, or under any contract or lease. This act shall not be construed to lessen or alter in any way the obligation in any lease between the United States of America, acting through any of its agencies, and the commonwealth requiring that the United States, or any agency or subdivision thereof, decontaminate lands where it terminates any lease in whole or in part. Nothing in this act shall be construed as an admission of liability for contamination of lands and waters of the reserve.

SECTION 15. Nothing in this act shall be construed to affect or modify any rights, duties, obligations or ongoing activities of the air force and coast guard within the reserve at the following locations:-

(*a*) the PAVE-PAWS site, so-called, consisting of approximately 87 acres as described in permit #DACA 51-4-81-475 issued by the United States Department of the Army to the United States Department of the Air Force; the site being a portion of land owned by the commonwealth and leased to the United States of America, represented by the Department of the Army, as described in its lease contract #DACA 51-4-81-475 and associated supplemental lease agreements; and

(*b*) the United States Coast Guard Transmitter site, so called, consisting of approximately 542 acres and shown as "Parcel P" on a plan of land entitled "Complied Plan Showing Leased Areas at Camp Edwards Military Reservation" scale 1"=2000', dated September 30, 1982, and prepared by the United States Army Corps of Engineers; the site being a portion of land owned by the commonwealth and leased to the United States of America, represented by the Department of Transportation, United States Coast Guard, as described in its lease document #31836.

SECTION 16. The Massachusetts army national guard shall have priority in the traditional training areas within the northern 15,000 acres of the MMR.

Approved March 5, 2002.

ENVIRONMENTAL PERFORMANCE STANDARDS

JULY 11, 2007

For Massachusetts National Guard Properties at the Massachusetts Military Reservation

CAMP EDWARDS TRAINING AREA GENERAL PERFORMANCE STANDARDS

None of the following banned military training activities shall be allowed in the Camp Edwards Training Areas:

-Artillery live fire
-Mortar live fire
-Demolition live fire training
-Artillery bag burning
-Non-approved digging, deforestation or vegetation clearing
-Use of' 'CS', riot control, or tear gas for training outside the NBC bunkers
-Use of field latrines with open bottoms
-Vehicle refueling outside designated Combat Service Area and Fuel Pad locations
-Field maintenance of vehicles above operator level

Limitations on the use of small arms ammunition and live weapon fire fall into the following two categories:

- Live weapon fire is prohibited outside of established small arms ranges. Live weapon fire is not allowed on established small arms ranges except in accordance with Environmental Performance Standard 19, other applicable Performance Standards, and a range-specific plan approved through the Environmental Management Commission (EMC).

- Blank ammunition for small arms and simulated munitions may be used in areas outside of the small arms ranges, using only blank ammunition and simulated munitions identified on an approved list of munitions. Joint review and approval for inclusion on the list shall be through by the Environmental & Readiness Center (E&RC) and the EMC.

Each user will be responsible for proper collection, management, and disposal of the wastes they generate, as well for reporting on those actions.

Use and application of hazardous materials or disposal of hazardous waste shall be prohibited except as described in the Groundwater Protection Policy.

Vehicles are only authorized to use the existing network of improved and unimproved roads, road shoulders, ranges and bivouac areas, except where necessary for land rehabilitation and management, water supply development, and remediation, or where roads are closed for land rehabilitation and management.

Protection and management of the groundwater resources in the Camp Edwards Training Area will focus on the following:

- Development of public and Massachusetts Military Reservation water supplies.
- Preservation and improvement of water quality and quantity (recharge).
- Activities compatible with the need to preserve and develop the groundwater resources.

All users of the Camp Edwards Training Area must comply with the provisions of the Groundwater Protection Policy and any future amendments or revisions to the restrictions and requirements. These will apply to all uses and activities within the overlays relative to Wellhead Protection, Zone II's within the Cantonment Area, and the Camp Edwards Training Areas.

Development of water supplies will be permitted within the Camp Edwards Training Area after review and approval by the managing agencies, principally the Department of the Army and its divisions, together with the Massachusetts Department of Environmental Protection, and the Massachusetts Division of Fish and Wildlife.

All phases of remediation activities will be permitted within the Camp Edwards Training Area after review and approval by the managing agencies, principally the Department of the Army and its divisions, together with the federal and state agencies who will have jurisdiction for remediation.

Pollution prevention and management of the Camp Edwards training ranges will focus on and include the following:

The Camp Edwards Training Area, including the Small Arms Ranges (SAR) and their associated "Surface Danger Zones," and any areas where small arms or other munitions or simulated munitions are used, shall be managed as part of a unique water supply area under an adaptive management program that integrates pollution prevention, and best management practices (BMP), including the recovery of projectiles. This will be done through individual range-specific plans that are written by the Massachusetts National Guard and approved for implementation through the EMC and any other regulatory agency having statutory and/or regulatory oversight. Adaptive, in this context, means making decisions as part of a continual process of monitoring, reviewing collected data, evaluating advances in range monitoring, design and technology, and responding with management actions as dictated by the resulting information and needs of protecting the environment while providing compatible military training within the Upper Cape Water Supply Reserve.

A range plan shall be designed and followed to reduce the potential for an unintended release to the environment outside of the established containment system(s) identified in the range-specific plans. All users must be aware of, and comply with, the Environmental Performance Standards that are applicable to all SAR activities. Any range specific requirements will be coordinated through the E&RC with the EMC, incorporating those specific requirements into the appropriate range-specific plans and range information packets. Camp Edwards SAR Pollution Prevention Plan shall be followed to prevent or minimize releases of metals or other compounds related to the normal and approved operation of each SAR. The adaptive SAR management program components required in each range-specific plan shall include:

- Consultation with applicable agencies with oversight of the training area before undertaking any actions that are subject to state and/or federal regulatory requirements.
- Specific recovery plans for the removal and proper disposition of spent projectiles, residues and solid waste associated with the weapons, ammunition, target systems, and/or their operation and maintenance.
- Reduction of adverse impacts to the maximum extent feasible, including consideration for the design/redesign and/or relocation of the activity or encouraging only those activities that result in meeting the goal of overall projectile and/or projectile constituent containment.
- Internal and external coordination of documentation for the Camp Edwards range management programs and other related Camp Edwards management programs including: the Integrated Training Area Management Program, Range Regulations, Camp Edwards Environmental Management System, Civilian Use Manual, and Standard Operating Procedures.
- Long-term range maintenance, monitoring and reporting of applicable parameters and analysis.

The Massachusetts National Guard shall ensure that all training areas where munitions or simulated munitions are used or come to be located, including range areas, range surface danger zones, and any other areas within the Upper Cape Water Supply Reserve that are operational ranges are maintained and monitored following approved management plans that include planning for pollution prevention, sustainable range use and where applicable, restoration.

Protection and management of the vegetation of the Camp Edwards Training Area for focus on the following:

- Preservation of the habitat for federal- and state-listed rare species and other wildlife.
- Preservation of the wetland resource areas.
- Activities compatible with the need to manage and preserve the vegetative resources.
- Realistic field training needs.
- Identification and restoration of areas impacted by training activities.

Goals for the Adaptive Ecosystem Management approach to management of the Camp Edwards properties will be as follows:

- Management of the groundwater for drinking water resources
- Conservation of endangered species.
- Management of endangered species habitat for continuation of the species.
- Ensuring compatible military training activities.
- Allowing for compatible civilian use.
- Identification and restoration of areas impacted by training activities.

The Environmental Performance Standards will be incorporated into the programs and regulations of the Massachusetts National Guard as follows. Those standards relating to natural resources management shall be incorporated as standards into each of the state and federal environmental management programs and attached as an appendix or written into the documentation accompanying the plan or program. All the Environmental Performance Standards will be attached to the Integrated Training Area Management Plan 'Trainer's Guide' and to the Camp Edwards Range Regulations. Modification of the Standards Operating Procedures will include review and conformance with the Environmental Performance Standards for trainers and soldiers at Camp Edwards.

SPECIFIC RESOURCE PERFORMANCE STANDARDS IN THE CAMP EDWARDS TRAINING AREA

1. Groundwater Resources Performance Standards

1.1. All actions, at any location within the Camp Edwards Training Areas, must preserve and maintain groundwater quality and quantity, and protect the recharge areas 1:0 existing and potential water supply wells. All areas within Camp Edwards Training Areas will be managed as State Zone II, and, where designated, Zone I, water supply areas.

1.2 The following standards shall apply to designated Wellhead Protection Areas:

- The 400-foot radius around approved public water supply wells will be protected from all access with signage. That protection will be maintained by the owner and/or operator of the well, or the leaseholder of the property.
- No new stormwater discharges may be directed into Zone I areas.
- No in ground septic system will be permitted within a Zone I area.
- No solid wastes may be generated or held within Zone I areas except as incidental to the construction, operation, and management of a well.
- Travel in Zone I areas will be limited to foot travel or to vehicles required for construction, operation, and maintenance of wells.
- No new or existing bivouac activity or area shall be located within a Zone I area.
- All other areas will be considered as Zone II designated areas and will be subject to the standards of the Groundwater Protection Policy.

1.3. Land-use activities that do not comply with either the state Wellhead Protection regulations (310 CMR 22.00 et seq.) or the Groundwater protection Policy are prohibited.

1.4. All activities will support and not interfere with either the Impact Area Groundwater Study and/or the Installation Restoration Program. All activities shall conform to the requirements of Comprehensive Environmental Response, Compensation and Liability Act, the Massachusetts Contingency Plan, and the Safe Drinking Water Act.

1.5. Extraction, use, and transfer of the groundwater resources must not de- grade [e.g. draw down surface waters] in freshwater ponds, vernal pools, wetlands, and marine waters, unless properly reviewed, mitigated, and approved by the managing and regulating agencies.

1.6. Land uses and activities in the Camp Edwards Training Areas will meet the following standards:

- Will conform to all existing and applicable federal, state and local regulations.
- Must be able to be implemented without interference with ongoing remediation projects.
- Allow regional access to the water supplies on the Massachusetts Military Reservation.

1.7. The following programs and standards will be used as the basis for protecting groundwater resources in the Camp Edwards Training Areas:

- Groundwater Protection Policy.
- Federal and Department of Defense environmental programs: Integrated Natural Resources Management Plan, Integrated Training Area Management Program, Range Regulations, Spill Prevention Control and Countermeasures Plan (or equivalent), Installation Restoration Plan, Impact Area Groundwater Study, or other remediation programs.
- State and federal laws and regulations pertaining to water supply.

2. Wetlands and Surface Water Performance Standards

2.1 Since there are relatively few wetland resources found at the Massachusetts Military Reservation, and since they are important to the support of habitat and water quality on the properties, the minimum standard will be no net loss of any of the wetland resources or their 100-foot buffers.

2.2 Land uses and activities will be managed to prevent and mitigate new adverse impacts and eliminate or reduce existing conditions adverse to wetlands and surface water resource areas. Impacts from remediation activities may be acceptable with implementation of reasonable alternatives.

2.3 Wetland area management priorities:

- Protection of existing; wetland resource areas for their contributions to existing and potential drinking water supplies.
- Protection of wetlands for rare species and their habitats.
- Protection of human health and safety.

2.4 Activities will be managed to preserve and protect wetlands and vernal pools as defined by applicable, federal, state, and local regulations. These activities will include replacement or replication of all wetland resource buffer areas, which are lost after completion of an activity or use.

2.5 All land altering activities within 100 feet of a certified vernal pool must be reviewed before commencement by the Massachusetts Department of Environmental Protection/Wetlands Unit and the Natural Heritage and Endangered Species Program within the Division of Fish and Wildlife for impacts to wildlife and habitat. The certification of vernal pools will be supported by the on site personnel and will proceed with the assistance of the appropriate state agencies.

2.6 All new uses or activities will be prohibited within the wetlands and their 100-foot buffers, except those associated with an approved habitat enhancement or restoration program; those on existing improved and un-improved roads where appropriate sediment and erosion controls are put in place prior to the activity; or those where no practicable alternative to the proposed action is available. No new roads should be located within the 100-foot buffers. Existing roads within such buffers should be relocated provided that:

- The relocation does not cause greater environmental impact to other resources.
- There are funds and resources allocated for resource management and that those resources are approved and available for the relocation.

2.7 During the period of 1 March to 15 June, roads within 500 feet of all wetlands will be closed to vehicle access to protect the migration and breeding of amphibians, with the following exceptions:

- The primary roads -Frank Perkins, Burgoyne, Gibbs and Greenway Roads will not normally be closed during this period.
- Emergency response and environmental management activities will not be restricted.

2.8 No new bivouac area shall be located within 500 feet of any wetland. Any existing bivouac within a wetland buffer shall be relocated provided there are funds and resources allocated for the relocation.

3. Rare Species Performance Standards

3.1 As the Natural Heritage and Endangered Species Program of the Massachusetts Division of Fisheries & Wildlife has identified the entire Massachusetts Military Reservation as State Priority Habitat for state-listed species (version dated 2000-2001), all activities and uses must comply with the Massachusetts Endangered Species Act and its regulations.

3.2 Where activities and uses are not specifically regulated under the Camp Edwards Training Area Range and Environmental Regulations, including these Environmental Performance Standards, the MMR Environmental and Readiness Center must review the activities for conformance with the Integrated Natural Resource Management Plan, and shall- consult with the Natural Heritage and Endangered Species Program regarding potential impacts to state-listed species.

3.3 All activities impacting rare species habitat must be designed to preserve or enhance that habitat as determined by the MMR Environmental and Readiness Center in consultation with the Natural Heritage and Endangered Species Program.

3.4 Users are prohibited from interfering with state and federal listed species.

3.5 Users will report all sightings of recognized listed species, e.g. box turtles, within any area of the Massachusetts Military Reservation.

4. Soil Conservation Performance Standards

4.1 Activities and uses must be compatible with the limitations of the underlying soils. Limitations on uses and activities may be made where the soils or soil conditions would not support the activity.

4.2 Agricultural soil types will be preserved for future use.

4.3 Any perennial or intermittent stream identified by the Environmental & Readiness Center Office will be protected from siltation by retaining undisturbed vegetative buffers to the extent feasible.

4.4 Cultural resource evaluations must be completed before any earth-moving operation may take place in undisturbed areas with high potential for cultural resources, and earth moving may be limited to specific areas (See Cultural Resource Performance Standards).

4.5 An erosion control analysis will be made part of the land management programs (Integrated Natural Resource Management Plan, the Integrated Training Area Management Program, Range Regulations, Civilian Use, and Standard Operating Procedures) for the Camp Edwards Training Area, including appropriate mitigation measures where existing or potential erosion problems are identified.

4.6 For all improved and unimproved roads, ditches and drainage ways:

- All unimproved roads, ditches, roads and drainage ways identified for maintenance will be cleaned of logs, slash and debris.
- Unimproved roads and roads may not otherwise be improved unless approved for modification.
- Any trail, ditch, road, or drainage way damaged by activities will be repaired in accordance with the hazard and impact it creates.

4.7 Erosion-prone sites will be inspecte4 periodically to identify damage and mitigation measures.

5. Vegetation Management Performance Standards

5.1 All planning and management activities impacting vegetation

- Will ensure the maintenance of native plant communities, and
- Shall be performed to maintain the biological diversity.

5.2 Revegetation of disturbed sites will be achieved by natural and artificial recolonization by native species.

5.3 Timber harvesting or clear-cutting of forested areas should not occur on steep slopes with unstable soils or with in the buffers to wetland resources.

5.4 Vegetation management will be subject to a forest management and fire protection program prepared by the users in accordance with federal standards, and carried out in a manner acceptable to the Massachusetts Military Reservation Committee and other state agencies or commissions, as may be designated by the Commonwealth of Massachusetts.

6. Habitat Management Performance Standards

6.1 The Camp Edwards Training Area will be managed as a unique rare species and wildlife habitat area under n adaptive ecosystem management program that integrates ecological, socio-economic, and institutional perspectives, and which operates under the following definitions:

- Adaptive means making decisions as part of a continual process of monitoring, reviewing collected data, and responding with management actions as dictated by the resulting information and needs of the system.
- Ecosystem means a system-wide understanding of the arrangements of living and non-living things, and the forces that act upon and within the system.
- Management entails a multi-disciplinary approach where potentially competing interests are resolved with expert analysis, user and local interest considerations, and a commitment to compromise interests when the broader goal is achieved to manage the Camp Edwards Training Area as a unique wildlife habitat area.

6.2 The adaptive ecosystem management program will include:

- Coordinated documentation for the management programs, Integrated Natural Resource Management Plan, the Integrated Training Area Management Program, Range Regulations, Civilian Use, and Standard Operating Procedures.
- The Massachusetts National Guard Environmental and Readiness Center staff and necessary funding to support its ecosystem management plans, as related to the amount of training occurring.
- Cooperative agreements to create a management team of scientific and regulatory experts.
- Long-term land maintenance, monitoring of resources and trends, study and analysis.
- Recovery plans for species and habitats identified for improvement.
- Consultation with Federal and State agencies charged with oversight of the Endangered Species Program before any actions that may affect state and federal-listed species habitat.
- Reduction of adverse impacts to the maximum extent possible, including consideration for the relocation of the activity or encouraging only those activities that result in meeting a habitat management goal.
- Habitat management activities designed to promote protection and restoration of native habitat types.

7. Wildlife Management Performance Standards

7.1 Native wildlife habitats and ecosystems management will focus on the following:

- Protecting rare and endangered species, and,
- Maintaining biodiversity.

7.2 Hunting, recreation and educational trips must be approved, scheduled, planned, and supervised through Range Control.

7.3 Any activity or use will prioritize protection of life, property, and natural resource values at the boundaries of the Camp Edwards Training Area where wildlife interfaces with the surrounding built environment.

7.4 Wildlife management will include the following actions, specific to the species targeted for management:

- Development and implementation of a plan to monitor hunting of game species.

- Planning for multi-use objectives for recreation and hunting that incorporate public input and recommendations.
- Development of suitable monitoring programs for federal and state-listed species, and regular exchange of information with the Natural Heritage and Endangered Species Program.

8. Air Quality Performance Standards

8.1 All uses and activities will be responsible for compliance with both the State Implementation Plan for Air Quality and the Federal Clean Air Act.

8.2 Air quality management activities will include air sampling if required by regulation of the activity.

9. Noise Management Performance Standards

9.1 Noise management activities shall conform to the Army's Environmental Noise Management Program policies for evaluation, assessment, monitoring, and response procedures.

10. Pest Management Performance Standards

10.1 Each user will develop and implement an Integrated Pest Management Program to control pest infestations that may include outside contracting of services. Non-native biological controls should not be considered unless approved by federal and state agencies.

10.2 Each user will be held responsible for management of pests that threaten rare and endangered species, or are exotic and invasive species, Invasive plant species that may be considered pest species are those defined by the United States Fish and Wildlife Service and the Massachusetts Natural Heritage and Endangered Species Program of the Division of Fisheries and Wildlife office. Site-specific analysis will be performed before implementation of any proposed pest management plans.

10.3 Pest vegetation control must be balanced against environmental impact and any proposed pest management activities, including the use of herbicides and mechanical methods, within rare species habitat areas must be approved by the Natural Heritage and Endangered Species Program, or in the case of federally-listed species, by the United States Fish and Wildlife Service.

10.4 Only herbicide formulations approved by the United States Environmental Protection Agency, the Department of Agriculture, the agency managing the user, and the Commonwealth of Massachusetts may be applied.

10.5 Herbicides and pesticides will not be applied by aerial spraying unless required by emergency conditions and approved under applicable state and federal regulations.

11. Fire Management Performance Standards

11.1 All activities and uses shall manage, prevent, detect, and suppress fires on the Camp Edwards Training Area in coordination with the local and state fire services and natural resource managers in the Environmental & Readiness Center.

11.2 Prescribed burns will be used as a habitat management and fire prevention tool. Prescribed burns will be used to reduce natural fire potential and create or maintain diverse and rare species habitat.

11.3 Pre-suppression activities will include strategic firebreaks and other management of vegetation in high-risk and high-incidence areas. The Integrated Natural Resource Management Plan and Fire Management Plan will be consulted for proposed actions.

11.4 Other than the above, no open fires are allowed.

12. Stormwater Management Performance Standards

12.1 All stormwater facilities shall comply with the State Department of Environmental Protection Guidelines for Stormwater Management, including Best Management Practices and all other applicable standards for control and mitigation of increased stormwater flow rates and improvement of water quality.

12.2 All increases in stormwater runoff will be controlled within the user's property.

12.3 No new stormwater discharges will be made directly into wetlands or wetland resource areas.

13. Wastewater Performance Standards

13.1 All wastewater and sewage disposal will be in conformance with the applicable Federal and Massachusetts Department of Environmental protection agency regulations.

14. Solid Waste Performance S1tandards

14.1. All solid waste streams (i.e., wastes not meeting the criteria for hazardous wastes) will be monitored and managed to substitute, reduce, recycle, modify processes, implement best management practices, and/or reuse waste, thereby reducing the total tonnage of wastes,

14.2. All users will be held responsible for collection, removal and disposal outside of the Camp Edwards Training Areas of solid wastes generated by their activities.

14.3 All users must handle solid wastes using best management practices to minimize nuisance odors, wind-blown litter, and attraction of vectors.

14.4 No permanent disposal of solid waste within the Groundwater protection Policy area/Camp Edwards field training areas will be permitted.

15. Hazardous Materials Performance Standards

15.1 Where they are permitted, use and application of hazardous materials shall be otherwise minimized in accordance with pollution prevention and waste minimization practices, including material substitution.

15.2 No permanent disposal of hazardous wastes within the Groundwater protection Policy area/Camp Edwards field training areas will be permitted.

15.3 Fuel Management

15.3.1 Spill Prevention, Control, and Countermeasure Plan, is in place to reduce potential for a release. Camp Edwards Spill Response Plan is in place to respond to a release if an event should occur. All users will comply with these plans at the Camp Edwards Training Area.

15.3.2 If found, non-complying underground fuel storage tanks will be removed in accordance with state and federal laws and regulations to include remediation of contaminated soil.

15.3.3 No storage or movement of fuels for supporting field activities, other than in vehicle fuel tanks, will be permitted except in approved containers no greater than five gallons in capacity.

15.3.4 New storage tanks are prohibited unless they meet the following requirements:

- Are approved for maintenance heating, or, permanent emergency generators and limited to propane or natural gas fuels.
- Conform to the Groundwater Protection Policy and applicable codes.

15.4 Non-fuel Hazardous Material Storage

15.4.1 No storage above those quantities necessary to support field training activities will be allowed within the Camp Edwards Training Area except where necessary to meet regulatory requirements, and where provided with secondary containment.

15.4.2 When required by applicable regulation, the user shall implement a Spill Prevention, Control and Containment/Emergency Response or other applicable response plan.

16. Hazardous Waste Performance Standards

16.1 All uses shall comply with applicable local, state, and federal regulations governing hazardous waste generation, management, and disposal (including overlays relative to Wellhead Protection, Zone II's within the Cantonment Area).

16.2 Accumulations of hazardous waste shall be handled in accordance with regulations governing accumulation and storage.

16.3 Existing facilities must implement pollution prevention and waste minimization procedures (process modifications, material substitution, recycling, and best management practices) to minimize waste generation and hazardous materials use.

16.4 Occupants and users will be held responsible for removing all solid or hazardous wastes generated during the period of use/tenancy/visitation upon their departure or in accordance with other applicable or relevant regulations.

16.5 Remedial activities undertaken under the Installation Restoration Program, the Impact Area Groundwater Study Program, the Massachusetts Contingency Plan, or other governing remediation programs are exempt from additional regulation (e.g., waste generation volume limits). Removal, storage, and disposal of contaminated material are required to comply with all state, and federal regulations.

16.6 Post-remedial uses and activities at previously impacted sites will be allowed in accordance with terms and conditions of the applicable regulations.

16.7 All hazardous wastes will be transported in accordance with federal Department of Transportation regulations governing shipment of these materials.

16.8 Transport shall reduce the number of trips for transfer and pick-up of hazardous wastes for disposal to extent feasible. This may include planning appropriate routes that minimize proximity to sensitive natural re-source areas, and reducing internal transfers of material, including transfers from bulk storage tanks to drums, tankers, carboys, or other portable containers or quantities.

16.9 No permanent disposal of hazardous wastes within the Groundwater Protection Policy area/Camp Edwards field training areas will be permitted.

17. Vehicle Performance Standards

17.1 Vehicles within the Camp Edwards Training Area will be limited to the existing improved and unimproved road system except where required for natural resource management or property maintenance or where off-road activity areas are located and approved by the Environmental and Readiness Center in consultation with the Massachusetts Division of Fisheries and Wildlife.

17.2 Unimproved, established access ways will be limited to use by vehicles in accordance with soil conditions as described in the Soil Conservation Performance Standards.

17.3 The number of military and civilian vehicles within the Camp Edwards Training Area will be controlled using appropriate scheduling and signage.

18. General Use and Access Performance Standards

18.1 General User Requirements. Requirements that will apply to all users, both public and private, in the Camp Edwards Training Area include the following:

- All acts that pollute the groundwater supply are prohibited.
- No litter or refuse of any sort may be thrown or left in or on any property.
- All users will be held responsible for providing, maintaining, and re- moving closed-system, sanitary facilities necessary for their use and activity.
- No person shall wade or swim in any water body except for activities approved by the Massachusetts National Guard including remediation, scientific study, or research.
- Vehicles may only be driven on roads authorized and designated for such use and parked in designated areas, and may not cross any designated wetland.
- Public users may not impede the military training activities.

18.2. Civilian Use Manual. To guide public conduct on the Massachusetts Military Reservation, a Civilian Use Manual will be prepared and periodically updated. All civilian users will obtain and follow this Manual.

18.3. Siting and Design Performance Standards

18.3.1 New or expanded buildings should not be proposed within the Camp Edwards Training Areas, with the following exceptions:

- Buildings to support allowed training, operations and activities, including upgrading of those facilities currently in place,

- Buildings used for the purposes of remediation activities,
- Buildings used for the purposes of development, operation and maintenance of water supplies,
- Buildings used for the purpose of natural resource and land management.

19. Range Performance Standards

19.1. All operational ranges including but not limited to small arms ranges (SAR) shall be managed to minimize harmful impacts to the environment within the Upper Cape Water Supply Reserve. Range management at each range shall include to the maximum extent practicable metal recovery and recycling, prevention of fragmentation and ricochets, and prevention of sub-surface percolation of residue associated with the range operations. Camp Edwards shall be held responsible for the implementation of BMPs by authorized range users, including collection and removal of spent ammunition and associated debris.

19.2. Small arms ranges shall only be used in accordance with approved range plans. These plans shall be designed to minimize to the maximum extent practicable the release of metals or other contaminates to the environment outside of specifically approved containment areas/systems. Occasional ricochets that result in rounds landing outside of these containment areas is expected and every effort to minimize and correct these occurrences shall be taken. Failure to follow the approved range plans shall be considered a violation of this EPS.

19.3. All operational SARs shall be closely monitored by the Massachusetts National Guard to assess compliance of the approved range plans as well as the implementation and effectiveness of the range specific BMPs.

19.4. Camp Edwards/Massachusetts National Guard Environmental and Readiness Center shall staff and request appropriate funding to support its SAR management plans.

19.5. All users must use and follow Camp Edwards' Range Control checklists and procedures to:

- Minimize debris on the range (e.g. shell casings, used targets)
- Minimize or control residues on the ranges resulting from training (e.g., unburned constituents, metal shavings from the muzzle blast)
- Ensure the range is being used for the designated purpose in accordance with all applicable plans and approvals

19.6. Camp Edwards is responsible for following range operation procedures and maintaining range pollution prevention systems. Range BMPs shall be reviewed annually for effectiveness and potential improvements in their design, monitoring, maintenance, and operational procedures in an effort to continually improve them. Each year the annual report shall detail the range-specific activities including, but not limited to, the number of rounds fired, number of shooters and their organization, and the number of days the range was in use. The annual report will also detail active SAR groundwater well and lysimeter results, as well as any range maintenance/management activities that took place that training year and the result of such activities, i.e. lbs of brass and projectiles recovered and recycled, etc. The Massachusetts National Guard shall provide regular and unrestricted access for the EMC to all its data and information, and will provide immediate access to environmental samples from the range, including range management and monitoring systems and any other applicable activities operating on the ranges.

19.7. Range plans and BMPs for training areas shall be reviewed and/or updated at least every three years. Management plans for new and upgraded ranges shall be in place prior to construction or utilization of the range. Range plans, at a minimum, will address long-term sustainable use, hydrology and hydrogeology, physical design, operation, management procedures, record keeping, pollution prevention, maintenance, monitoring, and applicable technologies to ensure sustainable range management. Range plans shall be integrated with other training area planning processes and resources.

19.8. The Massachusetts National Guard shall establish procedures for range maintenance and where applicable, maintenance and/or clearance operations to permit the sustainable, compatible, and safe use of operational ranges for their intended purpose within the Upper Cape Water Supply Reserve. In determining the frequency and degree of range maintenance and clearance operations, the Massachusetts National Guard shall consider, at a minimum, the environmental impact and safety hazards, each range's intended use, lease requirements, and the quantities and types of munitions or simulated munitions expended on that range.

APPENDIX D

Consent Agreement and Final Order

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1

In the Matter of:	Docket No. SDWA 01-2012-0021
Massachusetts National Guard	CONSENT AGREEMENT AND FINAL ORDER
Respondent.	

CONSENT AGREEMENT AND FINAL ORDER

1. The United States Environmental Protection Agency ("EPA") issues this Consent Agreement and Final Order ("CAFO") to the Massachusetts National Guard ("Respondent") under Section 1431(b) of the Safe Drinking Water Act ("SDWA" or "Act"), 42 U.S.C. § 300i(b), and the Consolidated Rules of Practice Governing the Administrative Assessment of Civil Penalties and the Revocation/Termination or Suspension of Permits ("Consolidated Rules of Practice"), 40 C.F.R. Part 22. Complainant is the Director, Office of Environmental Stewardship, United States Environmental Protection Agency, Region 1, and is delegated to issue this CAFO by National Delegation 9-62 and Regional Delegation 9-62.

2. EPA and Respondent agree that settlement of this matter is in the public interest, and that entry of this CAFO without litigation is the most appropriate means of resolving this matter.

3. Therefore, before taking any testimony, without adjudication of any issue of fact or law, and upon consent and agreement of the parties, it is hereby ordered and adjudged as follows:

I. STATUTORY AND REGULATORY BACKGROUND

4. Under Section 1431(a) of the Act, 42 U.S.C. § 300i(a), the Administrator of EPA, upon receipt of information that a contaminant which is present in or is likely to enter an underground source of drinking water, which may present an imminent and substantial endangerment to the health of persons, and that appropriate state and local authorities have not acted to protect the health of such persons, may take such actions as he may deem necessary in order to protect the health of such persons.

5. Under Section 1431(b) of the Act, 42 U.S.C. § 300i(b), the Debt Collection Improvement Act ("DCIA"), 31 U.S.C. § 3701, and EPA's Civil Monetary Penalty Inflation Adjustment Rules, promulgated thereunder at 40 C.F.R. Part 19, EPA may assess a civil administrative penalty of up to $16,500 per day for each violation of the SDWA.

II. PRELIMINARY STATEMENT

6. The provisions of this CAFO shall apply to and be binding on EPA and on Respondent, its officers, directors, successors and assigns.

7. Respondent admits that EPA has jurisdiction over the subject matter alleged in this CAFO. Respondent waives any defenses it might have as to jurisdiction and venue. Respondent consents to the terms of this CAFO, including but not limited to the assessment of a civil penalty, to the issuance of any specified compliance or corrective action order, and to any conditions specified in this CAFO.

8. Respondent neither admits nor denies the specific factual and legal allegations contained in this CAFO. For purposes of this CAFO and any action necessary to enforce it, Respondent hereby waives its right to request a judicial or administrative hearing or otherwise to contest the allegations in this CAFO, other than as specified in Paragraphs 70-74 (Dispute Resolution). Respondent waives any right to appeal this CAFO.

III. EPA FINDINGS

9. Respondent includes two principal divisions: the Massachusetts Army National Guard ("MAARNG"), and the Massachusetts Air National Guard.

10. The MAARNG is Respondent's land force.

11. The MAARNG is trained, and has its officers appointed, under the sixteenth clause of section 8, article I, of the Constitution.

12. The MAARNG is organized, armed, and equipped partly at Federal expense.

13. The MAARNG is part of the Army National Guard as defined by 10 U.S.C. § 101(c)(2).

14. The MAARNG is federally recognized within the meaning of 10 U.S.C. § 101(c)(2)(D).

15. The MAARNG is a "person" within the meaning of Section 1401(12) of the Act, 42 U.S.C. § 300f(12).

The Order Banning Firing of Lead Ammunition

16. On February 27, 1997, pursuant to Section 1431(a) of the Act, 42 U.S.C. § 300i(a), EPA issued Administrative Order SDWA I-97-1019 ("AO1") to the National Guard Bureau.

17. On April 10, 1997, pursuant to Section 1431(a) of the Act, 42 U.S.C. § 300i(a), EPA issued Administrative Order SDWA I-97-1030 ("AO2") to Respondent and also to the National Guard Bureau.

18. Following the initial signature of AO2 on April 10, 1997, EPA gave Respondent the opportunity to confer with EPA on the issuance of the order.

19. On May 16, 1997, the EPA Deputy Administrator upheld the issuance of AO2, directing EPA Region 1 to make certain modifications, and directed that the order, as modified, become effective on May 19, 1997.

20. Paragraph 2 of AO2 provides: "In the interests of environmental protection, public health and welfare, EPA hereby orders Respondents to undertake all actions required by this Order."

21. Paragraph 5 of AO2 provides: "This Order compels the Respondents National Guard Bureau and Massachusetts National Guard to implement pollution prevention measures to abate the threat to public health presented by the past and present contamination from the Massachusetts Military Reservation (MMR) Training Range and Impact Area. The required actions are described more fully in the attached Scope of Work (SOW) appended to this Order as Appendix A, which is enforceable hereunder."

22. Paragraph 77 of AO2 provides that "[t]he actions required by this Order are necessary to prevent further release or threat of release of contaminants and to protect the health of persons who are or may be users of the Sagamore Lens of the Cape Cod Aquifer. Based on the endangerment described above, the response actions in this Order are necessary. The response actions will consist of Respondents' implementation of the Scope of Work appended to this Order. The Scope of Work is designed to prevent, minimize, and/or mitigate damage to the health of persons which may otherwise result from the release or threat of release of contaminants."

23. Paragraph 78 of AO2 provides: "Based on EPA's jurisdiction, Findings of Fact, [and] Conclusions of Law set forth above, the Administrative Record supporting issuance of this Order, and in order to abate or prevent any imminent and substantial endangerment to health,

the Respondents are ORDERED to perform all Work required under this Order. The Respondents shall comply with the following provisions and perform all actions required by the terms and conditions of this Order."

24. Paragraph 86 of AO2 provides: "Immediately after EPA approval of Respondents' retention of the supervising contractor, unless modified pursuant to Section XXXIV of this Order, Modification of the SOW, the Respondents shall commence the work detailed in the Scope of Work. All work performed by the Respondents shall be conducted in accordance with . . . the provisions of this Order including any standards, specifications, and time schedules contained in the Scope of Work or specified by [EPA's Technical Project Coordinator]."

25. Paragraph 93 of AO2 provides in relevant part: "The Scope of Work and all other appendices or attachments to this Order shall be deemed incorporated into, and made an enforceable part of, this Order."

26. Paragraph II of Appendix A of AO2 ("Scope of Work") provides in relevant part: "Respondents shall perform the following Work: A. Respondents shall implement the following pollution prevention measures at or near the Training Range and Impact Area: 1. During the performance of the study of the Training Range and Impact Area being performed by the National Guard Bureau pursuant to the February 27, 1997 Order, and following completion of such study until EPA approves in writing the resumption of activities, except as provided in Section XXXIV of the Order, Modification of the SOW, Respondents shall suspend the following activities: a. All firing of lead ammunition or other 'live' ammunition at small arms ranges at or near the Training Range and Impact Area."

Respondent's Petition to Modify AO2

27. Paragraph 125 of AO2 provides in relevant part: "If a Respondent believes that a modification of the Work specified in the SOW or in work plans developed pursuant to the SOW is necessary and appropriate, Respondent may petition to EPA for an EPA determination on such potential modification, submitting appropriate documentation. Within a reasonable time after receipt of such petition, EPA will make a determination whether the SOW should be modified."

28. On June 13, 2007, Respondent, on behalf of itself and the National Guard Bureau, submitted to EPA a petition to modify the Scope of Work to AO2. Specifically, Respondent requested approval to resume firing with lead ammunition at T (Tango) Range, a small arms range on MMR.

29. Respondent's petition included, *inter alia*, a proposed operational plan entitled *T Range Best Management Practices: Operations, Maintenance, and Monitoring Plan* (T Range OMMP) prepared by URS Corporation for Respondent, and dated June 8, 2007.

EPA's Limited Authorization for Lead Ammunition Training ("LALAT")

30. After conducting a public comment period on Respondent's petition and considering oral and written comments submitted by members of the public, on July 23, 2007, EPA issued its response to the petition by letter to Respondent from EPA Region 1's Regional Administrator.

31. EPA's July 23, 2007 letter concluded, *inter alia*, that "a limited pilot project for resumption of training with lead ammunition is appropriate" but that "pollution prevention measures are necessary to ensure that the resumption of training with lead ammunition will not result in groundwater contamination."

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32. EPA's July 23, 2007 letter concluded, *inter alia*, that "[t]he measures identified in the *T Range Best Management Practices: Operations, Maintenance, and Monitoring Plan*, if performed as described, would be likely to accomplish the following: . . . minimize the amount of lead and other small arms-related contaminants that may migrate into the environment through the use of a STAPP Environmental Bullet Catcher which will capture the majority of bullets fired on the range . . . confirm that the environment is protected from releases of hazardous materials . . . [and] ensure that the capture system is properly maintained and functioning as designed, and . . . assure the system is inspected and operated in accordance with all requirements."

33. EPA's July 23, 2007 response also included a new Appendix B, entitled "Limited Authorization for Lead Ammunition Training" ("LALAT"), which allowed Respondent to conduct lead ammunition training at T Range as a pilot project for one training season from August 1, 2007 to December 31, 2008, subject to conditions. Specifically, the July 23, 2007 response modified Paragraph II.A.1.a of the Scope of Work to AO2 to read: "All firing of lead ammunition or other "live" ammunition at small arms ranges at or near the Training Range and Impact Area except as provided in Appendix B."

34. Paragraph II.C of Appendix B to AO2 provides in relevant part: "[D]uring the pilot period, Respondents and persons operating under their supervision may fire lead ammunition at T Range, subject to the following conditions: 1. Respondents must fully perform the activities described in the T Range Best Management Practices: Operations, Maintenance, and Monitoring Plan, which is hereby incorporated by reference . . . ."

35. Paragraph II.D of Appendix B to AO2 provides: "The conditions of Paragraph II.C are fully enforceable requirements of the Order and violations of any of the above conditions may be subject to penalties under the Order."

EPA's Revised Limited Authorization for Lead Ammunition Training ("RLALAT")

36. On January 28, 2009, upon request by Respondent, EPA again modified AO2 by adding Appendix C, entitled "Revised Limited Authorization for Lead Ammunition Training" ("RLALAT"). RLALAT allowed Respondent to conduct lead ammunition training on T (Tango), J (Juliet), and K (Kilo) Ranges, through December 31, 2009, subject to conditions. Specifically, these conditions included adherence to the provisions of: 1) the T Range OMMP (dated January 23, 2009); 2) the J and K Range OMMPs (dated January 23, 2009); and 3) the AO2, including Appendix A (Scope of Work) and Appendix B (LALAT).

37. On January 12, 2010, EPA by letter extended the RLALAT through December 31, 2010, and added one additional interim deadline.

38. On January 14, 2011, EPA by letter again extended the RLALAT through December 31, 2011, and added three additional interim deadlines.

39. Both the January 12, 2010 and the January 14, 2011 extension letters provided that "[t]he conditions for operation of Juliet, Kilo, and Tango Ranges shall remain in accordance with the 28 January 2009 EPA approval letter and Appendix C to . . . AO2."

40. On May 3, 2011, EPA by letter alleged that Respondent violated AO2 by failing to comply with the soil, groundwater, bullet containment system, and reporting requirements of the OMMPs of the respective ranges. By the same May 3, 2011 letter, pursuant to Paragraphs II.B.4 and II.G. of Appendix C, EPA modified Appendix C to incorporate additional requirements and to shorten the duration of the RLALAT to June 30, 2011. EPA's May 3, 2011

letter also explained that EPA considered "…MANG's failure to inform EPA of its ongoing noncompliance with the approved OMMPs, to be serious."

41. On June 27, 2011, EPA extended the RLALAT duration through December 31, 2011.

42. Subsequent to the May 3, 2011 letter, and the extension of the RLALAT, EPA identified additional violations, as described in Paragraphs 43 to 44 immediately below.

43. EPA identified that MANG had failed to remove and dispose of contaminated water that accumulated in the STAPP Bullet Capture System in accordance with the approved plans:

a.The T Range OMMP requires that "Camp Edwards will sample, collect, and properly dispose of the liquid that accumulates in the corrugated plastic reservoir within the T Range STAPP system after 15 cm of rain … or after 15 or more cm of water accumulates in the reservoir. Water removal from the internal reservoir will be scheduled to occur within 72 hours, weather permitting." Water was not collected and disposed of at T Range within 72 hours after 15 or more cm of water was measured in the reservoir on May 12, 2011, and including the following additional dates when 15 or more cm of water was measured in the reservoir: June 23, 2011, July 12, 2011, and August 17, 2011;

b. The J Range OMMP requires that "Camp Edwards will sample, collect, and properly dispose of the liquid that accumulates in the corrugated plastic reservoir within the J Range STAPP system after 15 cm of water accumulates in the reservoir. Water removal from the internal reservoir will be scheduled to occur within 72 hours, weather permitting." Water was not collected and disposed of at J Range within 72 hours after 15 or more cm of water was measured in the reservoir on July 14, 2011;

c. The K Range OMMP requires that "Camp Edwards will sample, collect, and properly dispose of the liquid that accumulates in the corrugated plastic reservoir within the K Range

STAPP system after 15 cm of water accumulates in the reservoir. Water removal from the internal reservoir will be scheduled to occur within 72 hours, weather permitting." Water was not collected and disposed of at K Range within 72 hours after 15 or more cm of water was measured in the reservoir on May 12, 2011, and including the following additional dates when 15 cm or more of water was measured in the reservoir: June 14, 2011, July 13, 2011, and August 12, 2011.

44. EPA identified that MANG had failed to notify EPA that water accumulated in the STAPP Bullet Capture System was not removed in accordance with approved plans, as follows:

a. In its May 3, 2011 letter, EPA required that "In the event that the MANG determines or anticipates that it may not be able to comply with any requirement (including sampling, reporting, range management, and ll other requirements) of the approved plans, the MANG shall within 24 hours of this determination notify EPA in writing, and within an additional 48 hours, submit a plan for EPA approval for addressing the potential deviation from the approved plan." MANG did not notify EPA within 24 hours of determining or anticipating that it might not be able to comply with the requirement to collect and dispose of water from the reservoirs at J, K and T Ranges, as follows:

i. For T Range, after measuring an exceedance of the action level on May 12, 2011, June 23, 2011, July 12, 2011, and August 17, 2011;

ii. For J Range, after measuring an exceedance of the action level on July 14, 2011; and

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48. Respondent shall continue to comply with AO2, as modified, and any other EPA directives related to AO2, at all times.

49. Respondent shall complete the following SEP, as described in Attachment 1, which the parties agree is intended to secure significant environmental benefits. The SEP consists of impervious surface removal at MMR, described in Attachment 1.

50. The total expenditure for the SEP shall not be less than $103,125. Respondent shall include documentation of the expenditures made in connection with the SEP, cumulatively through the date so indicated in the submittal of the SEP Completion Report, as part of the SEP Completion Report.

51. **Implementation.** Within 90 days of the effective date (the date of filing with the Regional Hearing Clerk) of this CAFO, Respondent shall commence implementation of the Attachment 1 measures, and shall thereafter implement the measures for a period of 9 months. With respect to implementation of the Attachment 1 measures, Respondent shall submit quarterly reports to EPA pursuant to Paragraph 52.

52. **Quarterly Reports.** Respondent shall submit quarterly written reports outlining work completed to date and funds spent to date. The quarterly reports will include copies of invoices documenting funds spent towards completion of the SEP. The reports shall be submitted to EPA by the 30th day of the month following each quarter (January, April, July, October).

53. **SEP Completion Report**. Respondent shall provide EPA with a letter indicating the actual date when the SEP is considered complete. Respondent shall then submit a SEP Completion Report within two months after the date of completion of the SEP. The SEP Completion Report shall contain the following information: (i) a detailed description of the SEP

as implemented; (ii) list of itemized costs for implementing the SEP; (iii) a certification by Respondent that the SEP has been fully implemented pursuant to the provisions of this CAFO; (iv) a description of any SEP operating problems encountered and the solutions thereto; and (v) a description of the environmental and public health benefits resulting from implementation of the SEP.

54. Respondent agrees that failure to submit the reports required by Paragraphs 52 and 53 shall be deemed a violation of this CAFO, and Respondent shall become liable for stipulated penalties pursuant to Paragraph 58.

55. Respondent shall submit all notices, submissions, and reports required by this CAFO to Lynne Jennings by First Class mail or any other commercial delivery service at the following address:

Lynne Jennings
U.S. Environmental Protection Agency, Region 1
5 Post Office Square, Suite 100 (OSRR07-3)
Boston, MA 02109-3912

56. For each requirement of this CAFO, including Attachment 1, Respondent shall maintain legible copies of the documentation and data used for any and all documents or reports submitted to EPA pursuant to this CAFO until such time that EPA accepts the SEP Completion Report, as provided in Paragraph 53. Respondent shall provide the documentation and data to EPA within 14 days of a request for such information. In all Attachment 1-related documents or reports submitted to EPA pursuant to this CAFO, Respondent shall, by one of its officers, sign and certify under penalty of law that the information contained in such document or report is true, accurate, and not misleading by signing the following statement:

> I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the

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iii. For K Range, after measuring an exceedance of the action level on May 12, 2011, June 14, 2011, July 13, 2011, and August 12, 2011.

b. In its May 3, 2011 letter, EPA also required that, "[b]y the 10th day of every month, MANG shall submit a monthly report that: … 4) describes all actions scheduled for the next six weeks and provide other information relating to the progress of the work under the Order, including information regarding percentage of completion, unresolved delays encountered or anticipated that may affect the future schedule for implementation of the work, and a description of effort made to mitigate those delays or anticipated delays." The monthly reports submitted by MANG in July, August and September did not contain any information regarding delays encountered by MANG and any efforts made to mitigate those delays.

45. Accordingly, EPA alleges that by failing to comply with the OMMPs of the respective ranges, Respondent violated an administrative order issued pursuant to Section 1431(a) of the Act, 42 U.S.C. § 300i(a).

46. Under Section 1431(b) of the Act, 42 U.S.C. § 300i(b), any person who violates or fails or refuses to comply with an administrative order shall be liable for a civil penalty of up to $16,500 per day for each violation.

IV. CONSENT AGREEMENT

47. Based upon the foregoing, and pursuant to Section 1431(b) of the Act, 42 U.S.C. § 300i(b), and the Consolidated Rules of Practice, it is hereby agreed by and between the parties, and Respondent voluntarily and knowingly agrees, as follows:

A. Supplemental Environmental Project

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48. Respondent shall continue to comply with AO2, as modified, and any other EPA directives related to AO2, at all times.

49. Respondent shall complete the following SEP, as described in Attachment 1, which the parties agree is intended to secure significant environmental benefits. The SEP consists of impervious surface removal at MMR, described in Attachment 1.

50. The total expenditure for the SEP shall not be less than $103,125. Respondent shall include documentation of the expenditures made in connection with the SEP, cumulatively through the date so indicated in the submittal of the SEP Completion Report, as part of the SEP Completion Report.

51. **Implementation**. Within 90 days of the effective date (the date of filing with the Regional Hearing Clerk) of this CAFO, Respondent shall commence implementation of the Attachment 1 measures, and shall thereafter implement the measures for a period of 9 months. With respect to implementation of the Attachment 1 measures, Respondent shall submit quarterly reports to EPA pursuant to Paragraph 52.

52. **Quarterly Reports**. Respondent shall submit quarterly written reports outlining work completed to date and funds spent to date. The quarterly reports will include copies of invoices documenting funds spent towards completion of the SEP. The reports shall be submitted to EPA by the 30th day of the month following each quarter (January, April, July, October).

53. **SEP Completion Report**. Respondent shall provide EPA with a letter indicating the actual date when the SEP is considered complete. Respondent shall then submit a SEP Completion Report within two months after the date of completion of the SEP. The SEP Completion Report shall contain the following information: (i) a detailed description of the SEP

as implemented; (ii) list of itemized costs for implementing the SEP; (iii) a certification by Respondent that the SEP has been fully implemented pursuant to the provisions of this CAFO; (iv) a description of any SEP operating problems encountered and the solutions thereto; and (v) a description of the environmental and public health benefits resulting from implementation of the SEP.

54. Respondent agrees that failure to submit the reports required by Paragraphs 52 and 53 shall be deemed a violation of this CAFO, and Respondent shall become liable for stipulated penalties pursuant to Paragraph 58.

55. Respondent shall submit all notices, submissions, and reports required by this CAFO to Lynne Jennings by First Class mail or any other commercial delivery service at the following address:

Lynne Jennings
U.S. Environmental Protection Agency, Region 1
5 Post Office Square, Suite 100 (OSRR07-3)
Boston, MA 02109-3912

56. For each requirement of this CAFO, including Attachment 1, Respondent shall maintain legible copies of the documentation and data used for any and all documents or reports submitted to EPA pursuant to this CAFO until such time that EPA accepts the SEP Completion Report, as provided in Paragraph 53. Respondent shall provide the documentation and data to EPA within 14 days of a request for such information. In all Attachment 1-related documents or reports submitted to EPA pursuant to this CAFO, Respondent shall, by one of its officers, sign and certify under penalty of law that thc information contained in such document or report is true, accurate, and not misleading by signing the following statement:

> I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the

> information submitted. Based on my inquiry of the person or persons who manage the system, the information is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment.

57. After receipt of the SEP Completion Report described in Paragraph 53, EPA will notify Respondent in writing that: (i) EPA concludes that the SEP has been completed satisfactorily; (ii) EPA has determined that the project has not been completed satisfactorily and is specifying a reasonable schedule for correction of the SEP or the SEP Completion Report; or (iii) EPA has determined that the SEP does not comply with the terms of this CAFO and is seeking stipulated penalties in accordance with Paragraph 58 . If EPA notifies Respondent pursuant to clause (ii) above that the SEP itself or the SEP Completion Report does not comply with the requirements of this CAFO, Respondent shall make such corrections to the SEP and/or modify the SEP Completion Report in accordance with the schedule specified by EPA. If EPA notifies Respondent pursuant to clause (iii) above that the SEP itself does not comply with the requirements of this CAFO, Respondent shall pay stipulated penalties to EPA in accordance with Paragraph 58.

58. **Stipulated Penalties.** (i) In the event that Respondent fails to complete the SEP in accordance with the terms of this CAFO, Respondent shall be liable for a stipulated penalty of $120,000 unless Respondent demonstrates, and EPA agrees, that Respondent made good faith and timely efforts to complete the project and certifies, with supporting documentation, that at least 90 percent of the amount of money that was required to be spent was expended on the SEP, in which case Respondent shall not be liable for any stipulated penalty. (ii) In the event that Respondent fails to submit the Quarterly Reports required by Paragraph 52, or fails to submit the SEP Completion Report required by Paragraph 53, Respondent shall pay a stipulated

penalty in the amount of $250 for each day after the Quarterly Report or SEP Completion Report was originally due until the date that the report is submitted. (iii) The determination of whether the SEP has been satisfactorily completed and whether Respondent has made good faith, timely efforts to implement the SEP shall be in the sole discretion of EPA. (iv) Stipulated penalties shall begin to accrue on the day after performance is due, and shall continue to accrue through the final day of the completion of the activity. (v) If the SEP is satisfactorily completed, but the Respondent spent less than 90 percent of the amount of money required to be spent for the project, Respondent shall pay a stipulated penalty to the United States equal to the amount resulting from the following calculation: The amount set forth in Paragraph 50 above, less the amounts actually expended by Respondent as documented pursuant to Paragraphs 52 and 53 above. (vi) If the SEP is satisfactorily completed, and the Respondent spent at least 90 percent of the amount of money required to be spent for the project, Respondent shall not be liable for any stipulated penalty. (vii) Respondent shall pay stipulated penalties not more than twenty-one (21) days after receipt of written demand by EPA for such penalties. The method of payment shall be in accordance with the provisions of Paragraphs 66.b and 66.c. Interest and late charges shall be paid as provided in Paragraph67.

59. Respondent certifies that, as of the date of this Consent Agreement, Respondent is not required to perform the SEP by any federal, state or local law or regulation, nor is Respondent required to perform the SEP under any grant or agreement with any governmental or private entity, as injunctive relief in this or any other case, or in compliance with state or local requirements. Respondent further certifies that it has not received, and is not presently negotiating to receive, credit in any other enforcement action for the SEP.

60. Respondent agrees that EPA may inspect its facilities at any time in order to confirm that the SEP is being undertaken in conformity with the representations made herein.

61. Respondent shall operate the SEP for a period as described in Attachment 1 to this CAFO. Respondent may seek an extension of time for initiating or performing an activity under the SEP in accordance with the Force Majeure provisions of Attachment 2, incorporated herein by reference.

62. Anti-Deficiency Act – It is the anticipation of the Parties to this CAFO that all obligations of MAARNG arising under this CAFO will be fully funded. MAARNG agrees to seek sufficient funding to fulfill its obligations under this Order. However, any requirement for the payment or obligation of funds by MAARNG established by the terms of this CAFO shall be subject to the availability of appropriated funds, and no provision herein shall be interpreted to require obligation of funds in violation of the Anti-Deficiency Act, 31 U.S.C. Section 1341. In cases where payment or obligation of funds would constitute a violation of the Anti-Deficiency Act, the dates established requiring the payment or obligation of such funds shall be appropriately adjusted.

63. Respondent agrees that any public statement, oral or written, in print, film, or other media, made by Respondent making reference to the SEP shall include the following language: "This project was undertaken in connection with the settlement of an enforcement action taken by the U.S. Environmental Protection Agency for violations of the Safe Drinking Water Act."

64. With respect to any injunctive relief or SEP under the terms of this CAFO:

a. this CAFO shall not be construed to constitute EPA approval of any equipment or technology installed by Respondent; and

b. Respondent agrees to indemnify, save and hold harmless the EPA, its officials, agents, contractors, subcontractors, employees and representatives, from any and all claims or causes of action: 1) arising from, or on account of, acts or omissions of Respondent, Respondent's officers, directors, employees, agents, contractors, subcontractors, receivers, trustees, successors or assigns; and 2) for damages or reimbursement arising from, or on account of, any contract, agreement, or arrangement between Respondent and any persons or entities for performance of work.

B. Civil Administrative Penalty

65. Based on Section 1431(b) of the Act, 42 U.S.C. § 300i(b), Respondent's agreement to perform a Supplemental Environmental Project ("SEP"), and other relevant factors, EPA has determined that an appropriate civil penalty to settle this action is in the amount of twenty-seven thousand, five hundred dollars ($27,500) plus interest if due pursuant to Paragraph 67.

66. The parties have agreed to a settlement on the following terms:

a. Respondent shall pay the civil penalty set forth in Paragraph 65 no later than 30 calendar days after the final date of this CAFO.

b. Respondent shall make payment by depositing in the United States mail a cashier's or certified check, or a check issued in the ordinary course of business conducted by Respondent, payable to the order of "Treasurer, United States of America" and referencing the title and docket number of the action ("In the Matter of Massachusetts National Guard, Docket No. SDWA 01-2012-0021"), in the amount of $27,500 to:

U. S. Environmental Protection Agency
Fines and Penalties
Cincinnati Finance Center
P.O. Box 979077
St. Louis, MO 63197-9000

The date said check is deposited in the mail shall be considered the date that the payment is made.

Or, Respondent may make payment by electronic funds transfer via:

Federal Reserve Bank of New York
ABA: 021030004
Account Number: 68010727
SWIFT address: FRNYUS33
33 Liberty Street
New York NY 10045
Field Tag 4200 of the Fedwire message should read:
"D 68010727 Environmental Protection Agency"

c. Respondent shall simultaneously submit copies of the penalty payment check or electronic funds transfer to:

Wanda Santiago
Regional Hearing Clerk
U.S. Environmental Protection Agency, Region 1
5 Post Office Square, Suite 100 (ORA18-1)
Boston, MA 02109-3912

and

Tim Conway
Senior Enforcement Counsel
U.S. Environmental Protection Agency, Region 1
5 Post Office Square, Suite 100 (OES04-3)
Boston, MA 02109-3912

67. Pursuant to 31 U.S.C. § 3717, EPA is entitled to assess interest and penalties on debts owed to the United States and a charge to cover the cost of processing and handling a delinquent claim. Interest will therefore begin to accrue on the civil penalty if it is not paid within thirty (30) calendar days of the entry of the CAFO. Interest will be assessed at the rate of the United States Treasury tax and loan rate in accordance with 31 C.F.R. § 901.9(b)(2), promulgated under 31 U.S.C. § 3717. A charge will be assessed to cover the costs of debt

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collection, including processing and handling costs and attorneys' fees in accordance with 31 C.F.R. § 901.9(c). In addition, a penalty charge of six percent per year compounded annually will be assessed on any portion of the debt which remains delinquent more than ninety (90) days after payment is due in accordance with 31 C.F.R. § 901.9(d). Should assessment of the penalty charge on the debt be required, it will be assessed as of the first day payment is due.

C. Retention of Rights

68. This CAFO constitutes a settlement by EPA of all claims against Respondent for civil penalties pursuant to Section 1431(a) of the Act, 42 U.S.C. § 300i(a), for the violations alleged in Section III of this CAFO. Compliance with this CAFO shall not be a defense to any other actions subsequently commenced pursuant to Federal laws and regulations administered by EPA for matters not addressed in this CAFO, and it is the responsibility of Respondent to comply with all applicable provisions of federal, state, or local law. EPA reserves all its other criminal and civil enforcement authorities, including the authority to seek injunctive relief and the authority to address imminent hazards.

D. General Provisions

69. All submissions required by this CAFO shall be sent to:

If by Respondent:

James T. Owens III, Director
Office of Site Remediation and Restoration
U.S. Environmental Protection Agency, Region 1
5 Post Office Square, Suite 100 (OSRR07-5)
Boston, MA 02109-3912
Attention: Lynne Jennings

If by EPA:

Colonel Richard V. Crivello
Commander
Army National Guard Training Site

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Camp Edwards, Massachusetts 02542-5003

E. Dispute Resolution

70. The dispute resolution procedures of Paragraphs 70-74 shall be the exclusive mechanism to resolve disputes arising under or with respect to Attachment 1 of this CAFO, including stipulated penalties relating to Attachment 1. However, such procedures shall not apply to actions by EPA to enforce obligations of Respondent that have not been disputed in accordance with these procedures.

71. **Informal Dispute Resolution.** Any dispute subject to dispute resolution under this CAFO shall first be the subject of informal negotiations. The dispute shall be considered to have arisen when Respondent provides written notice to EPA describing the nature of the dispute and requesting informal negotiations to resolve it. The period of informal negotiations shall not exceed twenty (20) days beyond the date that EPA receives Respondent's written notice unless EPA and Respondent agree in writing to a longer period. If the parties cannot resolve a dispute by informal negotiations, then the position advanced by EPA shall be considered binding unless, within fifteen (15) days after the conclusion of the informal negotiation period, Respondent invokes formal dispute resolution procedures as set forth below.

72. **Formal Dispute Resolution**. Respondent shall invoke formal dispute resolution procedures, within the time period provided in the preceding Paragraph, by providing written notice to EPA containing a statement of position regarding the matter in dispute. The statement of position shall includc, but may not be limited to, any factual data, analysis, or opinion supporting Respondent's position and any supporting documentation relied upon by Respondent. Following receipt of Respondent's statement of position submitted pursuant to this Paragraph, EPA will serve on Respondent its statement of position. EPA's statement of

position shall include, but may not be limited to, any factual data, analysis, or opinion supporting EPA's position and any supporting documentation relied upon by EPA.

73. Following receipt of the statements of position submitted by Respondent and EPA pursuant to Paragraph 72, the Director of the Office of Site Remediation and Restoration ("OSRR Director"), EPA Region 1, will issue a determination resolving the dispute. The determination of the OSRR Director shall be final. The parties to this CAFO each reserve any rights they may have under applicable law with respect to any appeal from the determination of the OSRR Director.

74. The invocation of dispute resolution procedures under this CAFO shall not extend, postpone, or affect any obligation of Respondent under this CAFO not directly in dispute, unless the final resolution of the dispute so dictates. Stipulated penalties with respect to the disputed matter shall continue to accrue from the first day of nonperformance, but payment shall be stayed pending resolution of the dispute as provided in this CAFO. If Respondent does not prevail on the disputed issue, stipulated penalties shall be assessed and paid as provided in Paragraph 58 above.

F. <u>Attorneys' Fees and Costs</u>

75. Each party shall bear its own costs and fees in this proceeding, including attorneys fees, and specifically waives any right to recover such costs from the other party pursuant to the Equal Access to Justice Act, 5 U.S.C. § 504, or other applicable law.

G. <u>Authorization and Binding Effect</u>

76. Each party certifies that at least one of its undersigned representatives is fully authorized to enter into the terms and conditions of this CAFO and to execute and legally bind such party to this document.

77. The provisions of the Consent Agreement shall be binding upon Respondent, its officers, directors, agents, servants, authorized representatives and successors or assigns.

In the Matter of Massachusetts National Guard **Docket No. SDWA 01-2012-0021**
Consent Agreement and Final Order

FOR MASSACHUSETTS NATIONAL GUARD:

L. SCOTT RICE
Major General, MA NG
The Adjutant General (Acting)
Date: 16 August 2012

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In the Matter of Massachusetts National Guard **Docket No. SDWA 01-2012-0021**
Consent Agreement and Final Order

FOR UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Susan Studlien — 08/28/12

Susan Studlien, Director — Date
Office of Environmental Stewardship
U.S. Environmental Protection Agency, Region 1

Timothy M. Conway — 08/29/2012

Timothy M. Conway — Date
Senior Enforcement Counsel
U.S. Environmental Protection Agency, Region 1

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In the Matter of Massachusetts National Guard Docket No. SDWA 01-2012-0021

FINAL ORDER

The foregoing Consent Agreement is hereby approved and incorporated by reference into this Final Order. The Respondent is hereby ordered to comply with the terms of the above Consent Agreement, which will become effective on the date it is filed with the Regional Hearing Clerk.

U.S. ENVIRONMENTAL PROTECTION AGENCY

LeAnn Jensen, Acting Regional Judicial Officer
U.S. Environmental Protection Agency, Region 1

August 30, 2012
Date

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Attachment 1 to Docket No. SDWA 01-2012-0021

Supplemental Environmental Project:
Impervious Surface Removal
Camp Edwards and Otis Air National Guard Base

Respondent, the Massachusetts National Guard, hereby agrees to undertake the following Supplemental Environmental Project ("SEP") in connection with the settlement of the enforcement action described in this CAFO.

A. **Background Information**

Respondent operates a portion of the Massachusetts Military Reservation ("MMR") facility on Cape Cod, Massachusetts ("Facility"). Respondent has identified approximately 14 acres of asphalt at the Facility that can be removed to reduce grassland bird habitat fragmentation and improve groundwater quality. The impervious surfaces that Respondent will remove, consistent with Section C below, are identified in Figure 1.

B. **Environmental Issues**

The presence of impervious surfaces at the Facility reduces overall groundwater quality, including limiting stormwater absorption capacity and groundwater recharge and allowing the flow of pollutants in stormwater in impacted areas. The impervious surfaces also fragment habitat for grassland bird species. The MMR facility area contains habitat for a number of endangered, threatened species, or species of special concern under Massachusetts law, including the upland sandpiper (Bartramia longicauda – endangered), the grasshopper sparrow (Ammodramus savannarum – special concern), the vesper sparrow (Pooecetes graminus – threatened), and the northern harrier (Circus cyaneus – threatened). The Massachusetts Department of Fish and Game, and its Division of Fisheries and Wildlife ("MA DFW") support this project. All areas within the grassland management resource area on the MMR are considered Priority and Estimated Rare Species Habitat for wildlife and rare species by the MA DFW Natural Heritage and Endangered Species Program ("NHESP").

C. **Project**

The SEP consists of the following which Respondent shall complete:

- Respondent shall remove 14 acres of existing impervious surfaces, as specified on Figure 1 to this SOW. After completion of approximately 5 acres of impervious surface removal, Respondent shall schedule a meeting with EPA project staff to review implementation to date, issues encountered, and issues anticipated with the remaining acres of impervious surface removal.
- Respondent shall remove and stockpile reclaimed materials at the site of the proposed UTES facility within MMR. Storage by Respondent of the reclaimed materials shall be in accordance with any applicable laws or regulations related to storage of the excavated asphalt material.
- Following the completion of the project, the areas will be monitored and maintained consistent with the grassland management provisions of the relevant Installation Integrated Natural Resource Management Plan ("INRMP"), whether it be the Camp Edwards INRMP or the 102nd IW INRMP.
- Impacts to Massachusetts Endangered Species Act ("MESA") species and the surrounding habitat, including but not limited to disturbance/stress due to machinery use, movement, and noise, shall be avoided, minimized or mitigated. Prior to initiating work in an area, Respondent shall have an experienced natural resources specialist inspect the work area

and propose measures, if necessary, to ensure that impacts are avoided, minimized or mitigated. The inspections shall continue as necessary throughout the project.

D. **Costs**

Respondent shall spend at least $103,125 to complete performance of the SEP. Respondent's allowable costs for purposes of the SEP may include labor base pay costs and gasoline, but shall not include base allowance for housing, or costs for use of Respondent's equipment.

E. **Environmental Benefits**

The SEP will increase stormwater absorption capacity, increase groundwater recharge and reduce the flow of pollutants in stormwater in impacted areas at the Facility. In addition, the SEP will also increase the area of non-fragmented habitat for grassland bird species. In particular, the SEP will benefit the following bird species: the upland sandpiper, the grasshopper sparrow, the vesper sparrow, and the northern harrier. Lepidoptera species (moths and butterflies) such as the state threatened pink streak (faronta rubripennis) occur and depend on this system for survival.

F. **CAFO Compliance and Reporting**

In performance of the SEP, Respondent shall comply with all requirements of the CAFO, including the SEP reporting requirements.

G. **Schedule**

Within 90 days of the effective date of the CAFO, Respondent, in accordance with the CAFO, shall commence implementation of the SEP measures. Once Respondent commences implementation of the SEP, Respondent shall thereafter continue implementing the SEP measures until complete; Respondent shall not exceed 275 days from commencement to completion of the SEP.

Attachment 2: Force Majeure

A. "Force Majeure" for purposes of this CAFO, is defined as any event arising from causes entirely beyond the control of Respondent, including its contractors and subcontractors, that delays or prevents the timely performance of the SEP under this CAFO notwithstanding Respondent's best efforts to avoid the delay. Force Majeure does not include Respondent's financial inability to perform any action under a SEP.

B. If an event occurs which causes or may cause Respondent to fail to fully comply in a timely manner with any provision of the SEP, Respondent shall provide written notice via electronic mail and overnight mail to EPA within seven (7) days of when Respondent first knew or should have known of the event. In the notice, Respondent shall specifically reference this Force Majeure Attachment 2, and describe the expected length of time the delay or impediment to performance may persist; the known or suspected causes of the delay or impediment; the measures taken or to be taken by Respondent to prevent or minimize the delay or impediment; and the timetable by which those measures will be implemented by Respondent.

C. Failure by Respondent to fully comply with the notice requirements set out in Paragraph B, above, shall render the remainder of this Attachment 2 void and of no effect as to the particular event involved, and shall constitute a waiver of Respondent's rights under this CAFO to obtain an extension of time based on such event.

D. If EPA agrees that Respondent's failure to comply with a provision of the SEP is attributable to Force Majeure, EPA and Respondent shall stipulate in writing to an extension of time for, or to a modification of, the performance of the affected requirements of the SEP, with any extension of time not to exceed the amount of time lost due to the actual unavoidable delay resulting from such circumstances. Stipulated penalties shall not accrue for the number of days constituting the actual unavoidable delay caused by such circumstances.


Supplemental Environmental Project
Impervious Surface Removal Area
Camp Edwards and Otis Air National Guard Base
North Truck Rd
Richardson Rd
Gaffney St
North Outer Rd
West Truck Rd
West Outer Rd
West Inner Rd
Generals Blvd
ATTACHMENT 1
CONSENT AGREEMENT AND
FINAL ORDER
SDWA 01-2012-0021
MA Air National Guard
MA Army National Guard
Impervious Surface Removal Areas, 14.09 Acres
Road
0
100
200
400 Meters
N

In the Matter of: Massachusetts National Guard
Docket No. SDWA-01-2012-0021

CERTIFICATE OF SERVICE

I hereby certify that, on the date referenced below, the foregoing Consent and Agreement and Final Order was delivered in the manner stated to the following persons:

Original and One Copy by Hand Delivery:

Wanda Santiago
Regional Hearing Clerk
U.S. EPA-Region 1
5 Post Office Square, Suite 100
ORA 18-1
Boston, MA 02109

Copy by Certified Mail, Return Receipt Requested:

Colonel Timothy A. Mullen
Chief Legal Counsel
Office of the Adjutant General
Massachusetts National Guard
50 Maple Street
Milford, MA 02109

Dated: 8/31/2012

Jeffrey C. Norcross, Paralegal
U.S. EPA-Region 1
5 Post Office Square, Suite 100
OES 04-4
Boston, MA 02109
Phone: (617) 918-1839
Fax: (617) 918-0839